APPENDIX A — OPINION OF THE UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT DATED AND REISSUED OCTOBER 30, 1998

United States Court of Appeals for the Federal Circuit

97-1232

INSITUFORM TECHNOLOGIES, INC., INSITUFORM (NETHERLANDS) B.V. and INSITUFORM GULF SOUTH, INC.,

Plaintiffs-Appellees,

v.

CAT CONTRACTING, INC., MICHIGAN SEWER CONSTRUCTION, KANAL SANIERUNG HANS MUELLER GmbH & CO. KG and INLINER U.S.A.,

Defendants-Appellants.

Reissued: October 30, 1998

Before MICHEL, *Circuit Judge*, ARCHER, *Senior Circuit Judge*, and SCHALL, *Circuit Judge*.

MICHEL, *Circuit Judge*.

Defendants, Cat Contracting, Inc. ("CAT"), Michigan Sewer Construction ("MSC"), Kanal Sanierung Hans Mueller GmbH & Co. KG ("KM"), and Inliner U.S.A. ("Inliner") (collectively, "Defendants") appeal the judgment of the United States District Court for the Southern District of Texas in *Insituform Technologies, Inc. v. Cat Contracting, Inc.*, CA No.

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H-90-1690 (Dec. 31, 1996) (hereinafter, "*Insituform II*"), holding Inliner's Processes 1 and 2 each infringes claim 1 of United States Patent No. 4,336,012 (the " '012 patent") under the doctrine of equivalents and enjoining Defendants from practicing either Process 1 or 2. Because we hold that Inliner's Process 1 was shown to infringe the '012 patent, but Inliner's Process 2 was not shown to infringe, and because as to one defendant, KM, the finding of infringement was clearly erroneous as entirely unsupported, at least on the record on appeal, we affirm-in-part, reverse-in-part, vacate-in-part and remand.

BACKGROUND

The '012 patent is directed towards a process for lining pipelines and passageways, particularly sewers, which may suffer from leaks. Using the patented method, damaged underground pipelines and passageways can be repaired without removing them from the ground. Claim 1 covers a method for the impregnation of a flexible tube liner prior to installing the liner in a damaged pipeline. The liner has an outer layer of impermeable film and an inner, resin-absorbent, felt layer. The claimed method involves applying a vacuum to the inside of the liner by cutting a window in the outer impermeable film layer, applying a cup to the outside of the window, and connecting the other end of the cup to a vacuum source using a flexible hose. As each section of the liner has its resin-absorbent material impregnated, the cup is moved downstream and the previous window is sealed. The process is repeated for respective lengths of liner until the entire liner has been impregnated. The resin-impregnated liner is then inserted into a damaged pipe. The method of installation in the pipe is not at issue here.

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Inliner's Process 1, the "multiple cup process," uses four to six cups to draw a vacuum from a corresponding number of windows in the liner. When the cup closest to the advancing resin is removed and the window that was beneath it is sealed, the remaining downstream cups continue to draw a vacuum in the liner. *See Insituform Gulf South, Inc. v. CAT Contracting, Inc.*, 99 F.3d 1098, 1104-05, 40 USPQ2d 1602, 1607 (Fed. Cir. 1997) (hereafter, "*Insituform I*"). Interruption of the vacuum during the impregnation process is thereby avoided or diminished by the use of the multiple cups. Inliner's Process 2, the "multiple needle process," replaces multiple cups with multiple metal tubes or needles. The needles are inserted through all of the layers of the liner rather than merely placed over holes in the outer layer, and they provide a continuous vacuum from inside the liner rather than through the felt. *See id.*[1]

In 1990, Insituform sued Defendants for infringement of the '012 patent and of United States Patent No. 4,009,063 (the " '063 patent"),[2] both claiming methods invented by Eric Wood and owned by Insituform Technologies, Inc. Liability and damages were bifurcated, and damages are not at issue here. In 1991, a jury returned a verdict that the '012 patent was infringed by both Processes 1 and 2 and was not invalid. The district judge granted Inliner's motion for JNOV with respect to literal infringement of both processes, and ordered a new trial with respect to infringement under the doctrine of equivalents. In 1995, at the retrial the court found equivalent infringement of claim 1 by both processes. On appeal, this court affirmed the

1. Inliner did not develop Process 2 until 1991, after the first phase of the case had already been tried to a jury.

2. The '063 patent is not at issue in this appeal.

order for JNOV with respect to literal infringement but vacated the district court's determination of equivalent infringement as based on an erroneous claim construction and remanded the case for re-determination of equivalent infringement based on the correct claim construction. *See Insituform I*, 99 F.3d at 1109, 40 USPQ2d at 1610.

Method claim 1, the only claim at issue, is reproduced below.[3] For background in the technology and in the patent in

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3. Claim 1:

> 1. A method of impregnating with a curable resin an inner layer of resin absorbent material disposed in an elongate flexible tube having an outer layer formed by an impremeable [sic] film, the method comprising the steps of
>
> (1) introducing into one end of the elongate tube a mass of the curable resin sufficient to impregnate the entire resin absorbent inner layer of the tube,
>
> (2) forming a window in the impermeable outer layer of the tube at a distance from said one end of the tube,
>
> (3) drawing through the window a vacuum in the interior of the tube downstream of said one end by disposing over the window a cup connected by a flexible hose to a vacuum source which cup prevents ingress of air into the interior of the tube while the tube is being evacuated, the outer layer of the tube being substantially impermeable to air,

(Cont'd)

suit, the reader is directed to *Insituform I*, 99 F.3d 1098, 40 USPQ2d 1602. In *Insituform I*, this court interpreted certain limitations of claim 1. Specifically, we held that the literal scope of claim 1 is limited to "a process using only one vacuum cup which inherently creates a discontinuous vacuum." *Insituform I*, 99 F.3d at 1106, 40 USPQ2d at 1608. Under the correct claim construction, we affirmed the district court's JNOV of

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(Cont'd)

(4) Beginning at or near the end at which the curable resin mass was introduced, passing the tube between squeezing members which force the resin to flow towards the region of vacuum application as the tube progresses through the squeezing members,

(5) when the resin reaches the vicinity of the region of vacuum application, removing the cup and sealing the window,

(6) providing another window in the impermeable layer of the tube downstream of the previously formed window,

(7) drawing through the new window a vacuum in the interior of the tube while progressively moving the tube through the squeezing members to force the resin to flow toward the new region of vacuum application, and

(8) repeating steps 5, 6, and 7, where necessary to impregnate the entire resin absorbent inner layer of the flexible tube.

'012 pat., col. 6, l. 37 - col. 7, l. 6.

no literal infringement because the accused Inliner methods use multiple cups or needles. *See id.* at 1107, 40 USPQ2d at 1608. We also concluded that the doctrine of prosecution history estoppel did not preclude Insituform from asserting that its right to exclude extends broadly enough to cover either Process 1 or Process 2, but we did not affirm the district court's finding of infringement under the doctrine of equivalents because it was based on an incorrect claim construction. *See id.* at 1109, 40 USPQ2d at 1610. We therefore vacated the determination of infringement by Processes 1 and 2 under the doctrine of equivalents and remanded the case for the district court to re-determine equivalent infringement applying the correct claim construction. *See id.*

On remand the court determined that both Inliner's Processes 1 and 2 infringed claim 1 of the '012 patent under the doctrine of equivalents. Inliner timely appealed to this court, and the appeal was submitted for our decision following oral argument on July 8, 1998. We have jurisdiction over this appeal pursuant to 28 U.S.C. § 1295(a)(1) (1994).

DISCUSSION

I. Prosecution History Estoppel

Although we held in *Insituform I* that "the prosecution history does not estop Insituform from asserting that the right to exclude extends broadly enough to cover either Process 1 or Process 2," *Insituform I*, 99 F.3d at 1109, 40 USPQ2d at 1610, Defendants now argue that the district court erred in its determination on remand that "[t]here is nothing in the file history of the '012 patent or the prior art which prevents claim 1 from covering Defendants' processes," *Insituform*, slip op

at 20 (Dec. 31, 1996). According to Defendants, however, the Supreme Court's *Warner-Jenkinson* decision, issued after our remand in *Insituform I*, further limited the doctrine of equivalents so that it cannot apply in this case. *See Warner-Jenkinson Co. v. Hilton-Davis Chem. Co.*, 520 U.S. 17, __, 117 S. Ct. 1040, 1051, 41 USPQ2d 1865, 1873 (1997) (holding that where no explanation is given for an amendment made during prosecution of a patent, a presumption is to be applied against the patentee that the amendment was made for purposes of patentability). Inliner asserts that when Insituform amended claim 1 in response to a 35 U.S.C. § 103 rejection of application claims 1-6 based on United States Patent No. 4,182,262 to Everson ("Everson"), Insituform necessarily gave up coverage of any process in which the vacuum was created at multiple vacuum sources because it provided no explanation for such a narrowing amendment.

As we discussed in *Insituform I*, however, Everson discloses "both the use of a continuous vacuum and the creation of that vacuum from only a single vacuum source at the far end of the tube opposite the resin source." *Insituform I*, 99 F.3d at 1108, 40 USPQ2d at 1609. Everson discloses nothing about multiple vacuum sources or their placement on the liner close to the resin front. In its response to the PTO rejection, Insituform canceled application claim 1 and filed a new, narrower claim in its place. The new claim, which became patent claim 1, incorporated each of canceled claims 1, 2, 3, and 4, but otherwise added no new limitations. In its remarks to the PTO, Insituform specifically noted that:

> Everson's method is ineffective when dealing with long lengths of tube because that method requires an exceedingly large suction compressor.

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> Applicant's method solves the problem of impregnating long lengths of tubing by forming a window in the tube's impermeable skin, drawing the resin to the region of the window by a vacuum . . . .

Response to First Office Action, March 30, 1982, p.4. We held, therefore, in *Insituform I*:

> Insituform solved this [Everson] problem by placing the suction source closer to the resin front thus allowing the use of a smaller suction compressor. *Thus, Insituform unequivocally gave up coverage to a process in which a single vacuum source is located at the far end of the tube.*

Id. at 1108, 40 USPQ2d at 1610 (emphasis added). The stated reason, therefore, for Insituform's amendment to overcome the Everson reference was to avoid the need to use a large compressor when the vacuum is created a significant distance from the resin source. *See id.* The *Warner-Jenkinson* presumption, therefore, which comes into play only when *no explanation* is given for a claim amendment, is not applicable to this case because Insituform made clear that the reason for the amendment was to overcome the prior art teaching creation of a single source vacuum at the far end of the liner.

Defendants argue, however, that other statements made in the remarks to the Patent Office warrant limitation of claim 1 by prosecution history estoppel to a single cup process. Again, we discussed such statements in *Insituform I*:

> in explaining its amendments, Insituform discussed the use of a single vacuum source which was to be

> moved along the tube as the resin front advanced. This suggests that Insituform envisioned the use of discontinuous vacuum created sequentially by only one vacuum source. However, *this statement alone is too equivocal to be read as a statement which would estop Insituform from equivalently covering a number of small compressors spread along the tube creating a continuous vacuum.*

Id. at 1108, 40 USPQ2d at 1610 (emphasis added). Defendants urge that the above-emphasized statement in *Insituform I* proves that Insituform did not explain why claim 1 was limited, and "[i]n [these] circumstances, prosecution history estoppel [should] bar the application of a doctrine of equivalents as to that element," *Warner-Jenkinson*, 117 S. Ct. at 1051, 41 USPQ2d at 1873.

In these remarks, however, Insituform was simply explaining the use of the claimed method and its statements did not negate the earlier-discussed, clear explanation of the reason for the amendment. Therefore, we hold that Insituform did explain the reason for its changes in claim 1, and those reasons do not prohibit application of the doctrine of equivalents completely, but only with respect to the subject matter surrender of a large, single vacuum source placed a significant distance from the resin front. *See Insituform I*, 99 F.3d at 1109, 40 USPQ2d at 1610. We conclude, as we did in *Insituform I*, that "prosecution history does not estop Insituform from asserting that the right to exclude extends broadly enough to cover either Process 1 or Process 2." *Id. Warner-Jenkinson* changed nothing applicable here. The district court's determination on remand after *Insituform I*, therefore, is affirmed.

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II. Infringement Under the Doctrine of Equivalents

Infringement, both literal and under the doctrine of equivalents, is a question of fact which we review for clear error when tried to the court. *See SRI Int'l v. Matsushita Elec. Corp. of Am.*, 775 F.2d 1107, 1125, 227 USPQ 577, 589 (Fed. Cir. 1985) (in banc); *see also Hilton-Davis Chem. Co. v. Warner-Jenkinson Co., Inc.*, 62 F.3d 1512, 1520, 35 USPQ2d 1641, 1657 (Fed. Cir. 1995) (in banc), *rev'd on other grounds*, 117 S. Ct. 1040, 520 U.S. 17, 41 USPQ2d 1865 (1997). "In applying the doctrine of equivalents, it is often enough to assess whether the claimed and accused products or processes included substantially the same function, way, and result." *Hilton-Davis*, 62 F.3d at 1518, 39 USPQ2d at 1645.

A. Process 1

The district court held that Defendants' Process 1, the multiple cup process, infringed claim 1 of the '012 patent under the doctrine of equivalents. Defendants argue, however, that the district court's determination was clearly erroneous because it ignores the substantial differences between the one-cup process of claim 1 and the accused multiple cup process.

Defendants specifically identify three "substantial differences": "[m]ore cups, continuous vacuum, [and] ability to impregnate longer, thicker liners faster, . . . We address each of these differences in turn. First, although claim 1 only claims the method of using one cup to impregnate the tube with resin, the multiple cups used in the accused process each perform precisely the same steps and functions as the single cup of the claimed method. Every limitation in claim 1, therefore, is met by at least one cup in Defendants' multiple cup process. That

all the cups together may not meet every limitation does not necessarily avoid equivalent infringement.

Second, Defendants assert that their multiple cup process draws a vacuum continuously whereas claim 1 inherently draws a vacuum discontinuously. A discontinuous vacuum is not a limitation of claim 1, although it is inherent in the operation of a single cup. In Defendants' accused method, the operation of each cup of the set draws a vacuum discontinuously, at least when it is moved from one location on the tube to another location further downstream of the resin front.

Moreover, the district court found that the use of multiple cups results "in a continuous vacuum which enhances the degree of vacuum achieved at the resin front," but that "there is nonetheless an insubstantial difference between" claim 1 and the multiple-cup process. We discern no clear error in this finding. There was evidence that the degree to which the multiple-cup process enhances the vacuum at the resin front, as compared to the single-cup process, is insubstantial. In particular, there was evidence that, in the claimed single-cup process, the amount of time when no vacuum was applied at the resin front was minimal so there was no substantial effect on the vacuum at that location. Furthermore, there was evidence that, like the single-cup process, the shifting of cups in the multiple-cup process results in a lessening of the vacuum at the resin front.

Third, Defendants argue that their method is more efficient because it can impregnate "longer, thicker liners faster." While Defendants' claim may be true, it is irrelevant because every one of claim 1's limitations is still met, at least equivalently. Hence, it does not matter that Defendants' Process 1 may be

better or more efficient. *See Amstar Corp. v. Envirotech Corp.*, 730 F.2d 1476, 1482, 221 USPQ 649, 653 (Fed. Cir. 1984) (quoting *McCullough Tool Co. v. Well Surveys, Inc.*, 343 F.2d 381, 402, 145 USPQ 6, 22 (10th Cir. 1965) ("infringement cannot be avoided by the mere fact that the accused device is more or less efficient or performs additional functions")).

Defendants, therefore, have not identified to us any substantial differences between the accused method and the limitations of the method of claim 1. The district court's determination of infringement of claim 1 by Process 1 under the doctrine of equivalents is therefore affirmed.

B. Process 2

The district court held that there were no substantial differences between Defendants' accused Process 2, the multiple needle process, and the method of claim 1. *Insituform*, slip op. at 18-19. The district court found:

> Both the cup and the tube [needle] are, as claim 1 states, "connected by a flexible hose to a vacuum source", both are the means provided for the application of vacuum, they both do the same thing (suck a vacuum) by the same means (being connected to a vacuum source) to achieve the same result (produce a satisfactory vacuum at the resin front).

Id. at 19. From this analysis it appears that the district court determined the "function" of the cup to be to "suck a vacuum," the "way" to be by "being connected to a vacuum source," and the "result" to be to "produce a satisfactory vacuum at the resin

front." Defendants assert on appeal that the court's function-way-result analysis is fatally flawed because it describes Everson. Although not clear to us that the district court's function-way-result analysis for the cup limitation would encompass the Everson patent, we nevertheless hold that the district court's function-way-result analysis involves too much overlapping and is overly broad. Specifically, the district court's identification of the limitation's "function" merges with the "way" and the "result": to provide a vacuum, to be connected to a vacuum source, and to produce a satisfactory vacuum at the resin front all define basically the same thing.

Under the proper "way" part of the function-way-result analysis, the "way" the cup provides a vacuum is by being disposed over a "window" cut in the outer, plastic liner of the tube and pressed on top of the exposed felt layer and being connected at the other end to a vacuum source. By contrast, the "way" Process 2 needles provide a vacuum is by being inserted through multiple punctures into the center of the tube (through the felt layer) and being connected at their other ends to a vacuum source. The question then becomes: are these two "ways" equivalent, or did the district court clearly err in holding that Defendant's Process 2 infringed claim 1 under the doctrine of equivalents? Defendants assert that the distinction between the cup and the needle is substantial, and the fact that the district court dismissed this distinction as "irrelevant" under the equivalents analysis is fatal.

Another factor that affects our equivalent infringement analysis is that the inventor of the '012 patent attempted to use a needle instead of a cup prior to filing his application. For a reason that is disputed by the parties, he changed to a cup, and when his patent application was filed, no mention of the possible

use of a needle was made. Insituform argues that the inventor's early use of needles shows that needles are old in the art and are known substitutions for cups. Defendants argue, however, that the inventor's "failure" with needles is evidence of a substantial difference between needles and cups. It is not apparent from the district court's opinion that it considered this prior attempt with needles. The evidence that the inventor first tried to use needles and then changed to cups without disclosing to the public that needles were, indeed, an option, supports an inference that the inventor was unable satisfactorily to practice his claimed method using a needle instead of a cup.

We therefore hold that, based on the evidence of substantial differences between the claimed single cup process and the accused multiple needle process, and the district court's legal errors in defining incorrectly the "way" in its function-way-result analysis and dismissing structural differences as irrelevant, the district court reversibly erred in finding that Defendants' multiple needle process infringed Insituform's claim 1 under the doctrine of equivalents. Once the "way" is correctly defined and the structural differences are properly considered, no reasonable trier of fact could have found the claimed single cup process and the accused multiple needle process to be equivalent.

III. District Court's Refusal to Consider Now Evidence

Prior to remand, this case had been tried twice on the issue of equivalent infringement, once to a jury and a second time to the court. Defendants now argue that the district court erred reversibly in refusing on remand to consider their new evidence of lack of equivalent infringement. We review the district court's refusal to allow Defendants to supplement the record

on remand for abuse of discretion. *See Westvaco Corp. v. International Paper Co.*, 991 F.2d 735, 745, 26 USPQ2d 1353, 1362 (Fed. Cir. 1993) (applying regional circuit law); *Rollins v. Fort Bend Indep. School Dist.*, 89 F.3d 1205, 1220 (5th Cir. 1996) (abuse of discretion standard).

Defendants assert that this "new" evidence showed, *inter alia*, the substantiality of the differences between the accused processes and method claim 1, and that Insituform witnesses had "not been truthful during testimony taken at the 1995 trial." Further, asserts Defendants, this court on remand gave the district court a "directive" to make new findings in accordance with the corrected claim construction, presumably necessitating at least the submission of further evidence.

We are unpersuaded, however, that the reasons cited by Defendants for the district court to accept supplemental evidence "mandate" its acceptance. First, our reversal today of the district court's finding of equivalent infringement of the multiple needle process shows that sufficient evidence was already present in the record based upon which the district court could have correctly decided the issue without submission of new evidence. Nor have Defendants shown that the evidence could not have been found and submitted at the first trial. Second, a review of the relevant language in *Insituform I* does not reveal a "mandate" for further, broader fact-finding by the district court. We therefore conclude that the district court did not abuse its discretion or remand in refusing to admit Defendants' supplemental evidence.

IV. Liability of KM

Defendants assert that the district court committed reversible error in holding that KM induced infringement of

the '012 patent. This issue was decided by the district court in 1995 and appealed to this court. Insituform argues that we considered this issue already in *Insituform I*, and that, therefore, it is the law of the case. We disagree. In *Insituform I*, we did not reach this issue because we vacated the district court's finding of direct infringement. *See Met-Coil Sys. Corp. v. Korners Unlimited, Inc.*, 803 F.2d 684, 687 (Fed. Cir. 1987) (Liability for inducement under § 271(b) is dependent on showing that the conduct being induced constitutes direct infringement.).

Defendants argue, *inter alia*, that the evidence fails to show that KM induced infringement of the '012 patent because the district court found, and Insituform does not dispute, that KM did not know of the existence of the '012 patent until after Insituform filed its complaint on February 2, 1990. Thus, Defendants assert, KM's acts cannot establish liability for inducing infringement of the '012 patent, because all accused acts by KM occurred before KM knew of the patent. A crucial element of induced infringement is that the inducer must have actual or constructive knowledge of the patent. A separate corporation related to KM licensed the infringing technology to Inliner after KM received notice of the '012 patent. The separate corporation is not a party to this case, and there were no findings that this affiliate was KM's alter ego. We agree that Defendants have shown clear error on the district court's finding that KM induced infringement. As the trial court made no finding on the alter ego issue, instead of reversing, we vacate the district court's holding and remand as to that issue.

V. Liability of MSC

Defendants assert that the district court committed reversible error in holding MSC fully liable as the other

defendants. Defendants argue that MSC's sole contribution to the joint venture was to provide financing, if necessary, and bonding. Defendants argue that "[d]uring trial in 1995, Inliner moved for JMOL on this issue," and the district court denied the motion. Defendants, however, did not raise this issue in *Insituform I*; and therefore, it is not properly before the court today. Because Defendants did not properly appeal this issue after the 1995 decision, it has been waived. Moreover, as Insituform asserts in response, the bifurcated damages trial will determine for what amount MSC is actually responsible, which may be less than for other defendants.

CONCLUSION

Because Defendants did not demonstrate clear error by the district court in its finding that Process 1 equivalently infringed claim 1 of the '012 patent, we affirm with respect to Process 1. With respect to Process 2, however, we hold that the district court did clearly err in finding that Defendants infringed and legally erred in its methodology; and therefore, we reverse. We further hold that the district court clearly erred in finding that KM induced infringement, and we vacate its holding and remand as to this issue. We do not review the district court's determinations of liability for MSC as that issue is not properly before us. The decision, therefore, is

AFFIRMED-IN PART, REVERSED-IN-PART, VACATED-IN-PART and REMANDED.

COSTS

Each party shall bear its own costs.

APPENDIX B — REVISED FINDINGS OF FACT AND CONCLUSIONS OF LAW DATED DECEMBER 27, 1996 AND ENTERED DECEMBER 31, 1996

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF TEXAS
HOUSTON DIVISION

CIVIL ACTION NO. H-90-1690

INSITUFORM TECHNOLOGIES, INC., INSITUFORM (NETHERLANDS) B.V., AND INSITUFORM GULF SOUTH, INC.,

Plaintiffs,

v.

CAT CONTRACTING, INC., MICHIGAN SEWER CONSTRUCTION COMPANY, KANAL SANIERUNG HANS MULLER GmbH & CO. KG, AND INLINER U.S.A.,

Defendants.

REVISED FINDINGS OF FACT AND CONCLUSIONS OF LAW

This case was tried to the Court from February 21, 1995 to February 23, 1995. At the conclusion of the case, this Court entered findings of fact and conclusions of law (Instrument No. 238) finding infringement under the doctrine of equivalents. Inliner appealed this Court's order denying its motion for judgment as a matter of law on the invalidity claim, this Court's order denying its motion to amend other claims, and the Court's order finding infringement under the doctrine of equivalents.

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The Federal Circuit has remanded this case to the district court for new findings on the issue of claim construction. The Court held that ". . . as the district court's doctrine of equivalents analysis was distorted by its incorrect claim construction, we must remand for new findings regarding this issue in accordance with the correct claim construction, . . .". The issue of claim construction is a matter of law for the court to decide, involving the review of patent specifications, prosecution history, language of the patent claims, and, if necessary, extrinsic evidence. *Texas Instruments v. U.S. Int'l Trade Com'n*, 988 F.2d 1165, 1171 (Fed. Cir. 1993). The court must decide and explicate its findings regarding claim construction on the record. *Genentech, Inc. v. Wellcome Foundation Ltd.*, 29 F.3d 1555 (Fed. Cir. 1994). Once the claim of a patent is interpreted to determine its scope and meaning, the court, as the factfinder in this case, can determine whether the accused device is within the scope of the properly constructed meaning. *North American Vaccine, Inc. v. American Cyanamid Co.*, 7 F.3d 1571, 1573 (Fed. Cir. 1993), *cert. denied*, 114 S.Ct. 1645 (1994). While the question of infringement is a question of fact, the Court has sufficient evidence before it to make a determination of infringement without additional proceedings. Accordingly, the Court issues the following "Second Amended Findings of Fact and Conclusions of Law:

FINDINGS OF FACT

Procedural History

1. In February 1990, Defendants were sued for infringement of U.S. Patents 4,009,063 of February 22, 1977 and 4,336,012 of December 18, 1982, both the inventions of Eric Wood and both now owned by Insituform Technologies, Inc.

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2. In 1991, there was a jury trial of the issues of infringement and validity of the '063 and '012 patents. The jury returned a verdict finding validity and infringement as to both patents.

3. Defendants moved for judgment notwithstanding the verdict or new trials as to all issues. Judge Hughes granted Defendants' JNOV motions with respect to literal infringement of both patents, ordered a new trial with respect to the issue of infringement by the doctrine of equivalents of both patents, and denied Defendants' motion in all other respects.

4. Trial of the issues of recoverable damages as against each defendant has been bifurcated, and is not here involved, nor was it involved in the 1991 trial.

5. The '063 patent expired February 22, 1984. The parties have stipulated that it is no longer involved in this lawsuit.

Parties and Jurisdiction

6. Plaintiff Insituform (Netherlands) B.V. ("Insituform") is a corporation of the Netherlands, with a principal place of business at Herengracht 552, Amsterdam 1001, Netherlands. Insituform Technologies, Inc. ("ITI") is a Delaware corporation, having a principal place of business at 3315 Democrat Road, Memphis, Tennessee 38118. Insituform Gulf South, Inc. ("INS") is a Texas corporation, having a principal place of business at 131 North Richey, Pasadena, Texas 77506.

7. Defendant Cat Contracting, Inc. ("CAT") is a Michigan corporation, having its principal place of business at 2022 FM 528, Alvin, Texas, 77518. Michigan Sewer Construction

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Company ("Michigan Sewer") is a Michigan corporation, having a principal place of business at 21720 West Eight Mile Road, Southfield, Michigan 48075. Kanal Mueller Gruppe International (KMG) is a corporation of the Federal Republic of Germany, having a place of business at 4938 Schieder-Schwalengerg, Federal Republic of Gemany. Kanal Sanierung Hans Mueller GmbH & CO KG ("KM"), is a licensee of KMG for the country of Germany. Inliner U.S.A. ("Inliner") is a corporation of the State of Delaware, having a principal place of business in Houston, Texas.

8. This Court has jurisdiction over the parties and the subject matter of this case 28 U.S.C. §§ 1331, 1338(a), 2201 and 2202. Venue is proper in the Southern District of Texas. 28 U.S.C. §§ 1391 and 1400.

Background

9. Sewer pipes and the linings of sewer pipes are subjected to stresses. That is particularly true in the case of underground sewer pipes. It is necessary that the lining be capable of withstanding those stresses for an appreciable period of time, as long as 50 years.

10. To accommodate those requirements, Eric Wood, through Insituform, pioneered a process in which the soft liners are made up of a relatively thick layer of felt which is impregnated with a thermosetting resin. (A themosetting resin is a resin which, when subjected to heat, will become hard but which, before the heat is applied, is soft.) After the felt liner has been put in place within the pipe to be repaired and has been pressed outwardly so as to conform to the pipe, the resin is heated, by flowing hot water through the lining, causing the

resin to set. The strength of the lining thus produced is primarily dependent upon the set resin which has impregnated the lining. It is essential, if the lining is to have the desired strength and longevity, that the impregnation of the felt by the resin be substantially uniform.

11. Soft linings of the type in question are inserted in lengths that are usually many hundreds of feet long. When such linings are impregnated with resin they weigh many tons. Some jobs have involved the use of as much of 100 tons of resin. The felt that is used is quite dense and it is difficult to get the resin into the felt and ensure that the felt is substantially fully impregnated by the resin. A way needed to be found to achieve a substantially complete impregnation of felt linings of the size involved with the understanding that the presence of any substantial amount of air in the liner after impregnation would be unacceptable.

12. The major impediment to uniform impregnation of the felt by the resin is the presence of air in the felt. The resin must displace the air, and do so substantially completely, if the felt is to be uniformly and satisfactorily impregnated.

13. Early on in the development of this technology, it was learned that the impregnation process would be greatly facilitated if air were to be sucked from the interior of the felt tube. During the impregnation process, a method was utilized where a vacuum pump was connected at the far end for the lining and air was sucked out of the lining from that far end until a satisfactory vacuum was created in the lining. That is what is shown in Everson patent 4,182,262 of 1980 and in the British Rhys-Jones article of 1975. It took a very appreciable length of time before sucking air from the free end of the liner

produced a satisfactory vacuum at the point in the liner where the resin was beginning to enter the felt (the "resin front"), and impregnation could not start until that had been accomplished. The lengths of the liners used at the time of Everson and Rhys-Jones were relatively short, however, so the length of time involved was marginally acceptable. As the length of the liners increased, the time needed to produce the desired vacuum at the resin front increased as the square of the distance involved — a liner twice as long would need four times as much time, and a liner four times as long would need sixteen times as much time. It is to this problem that the patent in suit, 4,366,012 of December 28, 1982, is directed.

The Patent In Suit

14. When Mr. Wood filed the patent application, original claim 1 called broadly for the application of the vacuum while the impregnation process is taking place. Original claims 2 and 3 added to claim 1 that the resin was introduced into one end of the tube and fed down the tube by means of nip rollers and the vacuum was applied to the interior of the tube downstream of the resin mass. Original claim 4 added to the above that the vacuum was applied through a window formed in the wall of the tube by means of a cup connected to a source of vacuum, the cup moving with the tube during its movement relative to the nip rollers, and the cup being removed and applied to a position spaced downstream from the previous window, the previous window being sealed by means of a patch or the like, whereby the process is repeated for respective lengths of the tube until the entire tube length has been impregnated.

15. The Patent Examiner, in his first action on the merits, rejected all of those claims on the basis of the Everson patent,

the Examiner saying: "The claimed process does not appear to differ in any unobvious aspect from that of the reference."

16. In response, by amendment dated April 6, 1982, applicant canceled the official claims and added the claims that appear in the patent. Patent claim 1 reads as follows:

> a. A method of impregnating with a curable resin an inner layer of resin absorbent material disposed in an elongate flexible tube having an outer layer formed by an impermeable film, the method comprising the steps of
>
> > (1) introducing into one end of the elongate tube a mass of the curable resin sufficient to impregnate the entire resin absorbent inner layer of the tube,
> >
> > (2) forming a window in the impermeable outer layer of the tube at a distance from said one end of the tube,
> >
> > (3) drawing through the window a vacuum in the interior of the tube downstream of said one end by disposing over the window a cup connected by a flexible hose to a vacuum source which cup prevents ingress of air into the interior of the tube while the tube is being evacuated, the outer layer of the tube being substantially impermeable to air,
> >
> > (4) beginning at or near the end at which the curable resin mass was introduced,

passing the tube between squeezing members which force the resin to flow towards the region of vacuum application as the tube progresses through the squeezing members,

(5) when the resin reaches the vicinity of the region of vacuum application, removing the cup and sealing the window,

(6) providing another window in the impermeable layer of the tube downstream of the previously formed window,

(7) drawing through the new window a vacuum in the interior of the tube while progressively moving the tube through the squeezing members to force the resin to flow toward the new region of vacuum application, and

(8) repeating steps 5, 6, and 7, where necessary to impregnate the entire resin absorbent inner layer of the flexible tube.

17. Applicant explained the similarity of the new claim to the original application claim 4 to the Examiner as follows: "(Application) Claim 10 (ultimately patent claim 1) incorporates the substance of canceled claims 1, 2, 3 and 4." Applicant's total argument to the Examiner as to the patentability of that claim was as follows:

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The principal reference relied on in the rejection of claims 1 to 6 is the patent to Everson (U.S. 4,182,262). Everson's method is ineffective when dealing with long lengths of tube because that method requires an exceedingly large suction compressor. Applicant's method solves the problem of impregnating long lengths of tubing by forming a window in the tube's impermeable skin, drawing the resin to the region of the window by a vacuum while squeezing the tube to force the resin to flow toward the evacuated region, sealing the window, and repeating the process at another window farther downstream. Thus by iterating and reiterating that process, the resin is drawn along to impregnate the entire length of the tube.

It is submitted that applicant has taught an improvement upon Everson's method which makes feasible the impregnation of long tube lengths and that the grant of a patent on that improvement is merited.

Accordingly, reexamination of this application is requested.

18. Patent claim 2 covers the subject matter of original application claim 5, and reads as follows:

2. The method according to claim 1, further including the step of forming an initial air seal at the end of the flexible tube at which the mass of resin was introduced by closing off that end of the tube after introduction of the mass of resin and

> before vacuum is applied to the interior of tube to draw the resin toward the region of vacuum application.

19. Patent claim 3 covers the subject matter of original application claim 6, and reads as follows:

> 3. The method according to claim 1, wherein said outer layer of the flexible tube is defined by a felt sheet coated with a synthetic resinous material that forms said film, the method further including the steps of
>
> (i) sewing together adjacent edges of the felt sheet to form the tube, and
>
> (ii) covering the resultant seam with a sealing strip that is impervious to air.

20. With the explanations and clarifications to the Examiner, the application was then allowed. U.S. Patent No. 4,366,012 ('012 Patent), entitled "Impregnation Process," issued to Eric Wood on December 28, 1982. Insituform is the owner of the '012 patent. ITI is the exclusive licensee within the United States, and has granted a sublicense to INS for territory that includes the City of Houston. It is still in full force and effect, and for purposes of this proceeding its validity is established.

Background of Earlier Proceedings

21. In early 1989, after reading about KM's proprietary sewer rehabilitation technology in a trade magazine, Mr. Guilio

Catallo, the president of CAT, contacted KM for the purpose of obtaining a license for that technology. In March 1989 he traveled to Europe to observe KM's process for impregnating and installing liners in underground sewer lines, and to negotiate a license from KM.

22. On March 17, 1989, Mr. Catallo signed a letter of intent with KM to license the technology. On March 21, he submitted a bid on behalf of CAT Contracting and Michigan Sewer to perform pipe rehabilitation services for the City of Houston, specifically, Wastewater Job Nos. 3907-12 and 3907-16, sometimes referred to as the "Sims Bayou Contracts." CAT/ Michigan Sewer (a joint venture) submitted the low bid and was eventually awarded the contract.

23. During the bidding process, Mr. Catallo received a letter dated April 7, 1989 from Insituform's attorney, Mr. Harold James, notifying CAT and Michigan Sewer that if they practiced the process being utilized by KM, they would infringe U.S. Patents 4,009,063 ('063 patent) and 4,786,345 ('345 patent). The letter did not mention the '012 patent, nor was Mr. Catallo notified of the '012 patent until this lawsuit was filed.

24. On February 2, 1990, Plaintiffs filed an original complaint against Defendants in the Eastern District of Michigan, alleging infringement not only of the '063 and '345 patents, but also of the '012 patent. In May 1990 the case was transferred to the Southern District of Texas. The Plaintiffs filed an amended complaint in this court, realleging infringement of the '063 and '012 patents, but dropping charges relating to the '345 patent. Defendants filed an answer, alleging that, among other things, the patents were not infringed.

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25. In June 1991, after a two-week trial, a jury returned a verdict that included the finding that both patents were infringed. Defendants filed motions for new trial and judgement notwithstanding the verdict. In pertinent part, the Defendants argued that the evidence showed that Plaintiffs were legally estopped from construing claim 1 to cover Defendants' Multiple Cup Process ("Process 1," discussed in greater detail below), either literally or by the doctrine of equivalents.

26. In August 1991 this Court partially granted Defendants' motions, ordering a judgment notwithstanding the verdict on the issue of literal infringement of both patents, and granting a new trial on the issue of infringement under the doctrine of equivalents. The issue of damages had previously been bifurcated from the issue of infringement by order of the Court dated March 5, 1991. Although the March 5, 1991 order also erroneously referred to the bifurcation of the defendants' counterclaim for antitrust violations, the Defendant's motion for leave to amend to add a claim for antitrust violations was never granted, and has been subsequently denied by this Court.

27. In January 1995 Plaintiffs dismissed with prejudice their charges of infringement of the '063 patent, leaving as the only issue whether Defendants infringe the '012 patent under the doctrine of equivalents. In addition to the Multiple Cup Process (Process 1), the Plaintiffs are alleging that the Multiple Needle Process (Process 2) also infringes the '012 patent. Process 2 was not accused of infringement in the original trial, nor had Process 2 been disclosed by the Defendants at the time of the first trial.

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Defendants' Accused Impregnation Processes

28. Defendants have carried out in this country or, in the case of KM, have induced the carrying out of processes for the rehabilitation of pipelines using a lining formed primarily of an appropriate thickness of felt impregnated with a thermosetting resin, which lining when soft is inserted into the damaged pipe, urged out toward the pipe interior, and subjected to heat in order to set the resin. The strength of Defendants' linings, like that of plaintiffs' lining, depends upon the thickness of the lining and the substantially complete impregnation of the felt by the unset resin. Defendants have over the years varied the impregnation process that they employed, but in all of those processes the felt is in tubular form with an impermeable film on the outside, a mass of resin sufficient to impregnate a predetermined extensive length of the liner (sometimes the entire length of the liner) is introduced into the tube, an opening is made in the impermeable film at a predetermined distance from the resin, vacuum is drawn through that opening, the lining is caused to move through squeezing rollers located upstream of the resin mass, and when that resin mass, because of the movement of the lining through the squeezing rollers, approaches the opening through which suction is being exerted, that is to say, the vicinity of the region of vacuum application, the vacuum source is removed from that opening, the opening is sealed, a new opening is provided in the impermeable layer downstream of the resin, vacuum is drawn through the new opening, the lining being progressively continuously moved and the process is repeated for whatever number of times are required for the given length of lining and the amount of resin introduced.

29. There are three variations in the impregnation process carried out by Defendants. In one, which Mr. Catallo testified

at the first trial was carried out about 20% of the time, the vacuum was applied by means of a single vacuum cup which remained in place throughout the impregnation process.

30. In a second process described at the first trial and here called Process 1 by Defendants, a plurality of vacuum cups (usually four) were simultaneously applied to a corresponding plurality of openings along the length of the liner. When the resin front approaches the region of vacuum application (the leading cup), it is removed and that opening is sealed, the second cup is removed and the first cup is put in its place, the third cup is removed and the second cup is put in its place, and so on until finally the last cup is removed, a new opening is formed in the impermeable layer downstream of the last then-existing opening, and the last cup is placed over that new opening. The lining is moved continuously through the nip rollers as this goes on.

31. Since the first trial, Defendants have gone to a third process, here called Process 2 by Defendants, which modifies Process 1 in two respects. First, instead of using a vacuum cup, they use a tube (they call it a "needle") connected at one end to the vacuum pump with its other end penetrating the impermeable film and being exposed to the felt, vacuum being drawn through that tube. Second, instead of shifting all of the tubes when the first tube approaches the resin front, they leave tubes 2 and 3, etc. in place and when the first tube is removed and its hole sealed, that first tube is moved to a position downstream from the last tube, where it is caused to penetrate the lining and draw a vacuum.

32. In both of these multi-cup Processes 1 and 2, Defendants are removing the suction source (cup or tube) from

the hole close to the resin front, sealing that hole, making a new opening downstream and applying the suction source (cup or tube) to that new hole, and continuing that procedure sequentially while the lining is continuously moving through the squeezing rollers and over the mass of introduced resin.

33. K-M also uses an impregnation process involving the sequential application of vacuum to the liner, which was demonstrated to Mr. Catallo when he visited Germany and before he commenced his activities complained of in this lawsuit. In that process an opening is formed relatively near the resin front and a vacuum cup is applied. When that opening approaches the resin front, a second opening is made downstream of the lining and a second vacuum cup is applied, the first vacuum cup is removed, the first opening is sealed, and the process is continued sequentially for as long as is appropriate.

The Function of the Vacuum

34. What the vacuum does in the impregnation process is ensure that there is as little air as possible in the felt at the resin front, where the resin is entering the felt. The presence of air elsewhere in the felt is of no direct significance. It is only the vacuum in the felt at the resin front which determines the degree to which impregnation of the felt by the resin occurs.

35. The felt before impregnation is quite dense, so that air flow through it is restricted. That is one reason why, when suction is exerted only from the far end of the liner, it takes many hours to produce an adequate degree of suction at the resin front, and that is why the suction process disclose in the Everson and Rhys-Jones prior art references, while marginally

practical when employed with relatively short and narrow linings, is totally impractical if employed with longer and wider linings such as are commonplace today.

36. When the suction source (cup or tube) approaches the resin front and is removed, exposing the opening through which suction had previously been drawn, air tends to enter the lining through that opening and reduce the degree of suction within the lining, and particularly at the resin front. However, it is only a matter of five second or less to remove the suction source and seal the opening, and during that time very little air enters the lining and reaches the resin front. Similarly, only a very few seconds is involved between making the second opening, through which air tends to enter, and covering that second opening with the suction source, and in practice only about 15-20 seconds is involved in the entire procedure of removing the section source, sealing the opening, making the new opening and applying the suction source to the new opening. During that time, the degree of vacuum at the resin front does decrease somewhat, but not to a material degree. In practice the impregnation process continues uninterrupted during that time, with the lining continuously moving forward at a constant speed and the resin continuously impregnating newly presented portions of the felt.

37. Hence, in the single-cup process disclosed in the '012 patent, while the act of sucking air from the liner is interrupted during the few seconds required to effectuate the shift in position of the suction cup, and the degree of suction at the resin front decreases as a result, there is always a sufficient degree of vacuum at the resin front to provide for effective substantially complete impregnation of the felt. The vacuum within the liner, and particularly the vacuum at the resin front,

is not interrupted or discontinuous. It is variable, but to a degree which makes no difference insofar as substantially complete felt impregnation is concerned.

38. The claim of the patent calls for forming a window and disposing a cup over that window to create a vacuum. Although the scope of the claim is limited to a process which uses only one vacuum cup that results in a discontinuous vacuum, Insituform and its licensees sometimes use the single-cup process, but more often the multiple-cup process, because the multiple-cup process more rapidly achieves the desired vacuum at the resin front when relatively wide or thick liners are being impregnated. The reason wide or thick liners call for multiple cups is that with them the cross-sectional area of the felt exposed to the resin is quite large, making the obtaining of an adequate vacuum more difficult. The more suction cups that are working at any one time the more rapidly is the requisite degree of vacuum achieved at the resin front. The shifting of cups in the multiple-cup process results in a lessening of the vacuum at the resin front, just as in the case of the single-cup process, but the difference in degree in either the single-cup or multiple-cup process is not material in the overall carrying out of the impregnation process.

39. The claim calls for "an outer layer formed by an impermeable film." The purpose and function of that outer layer is to keep the resin in the felt during the impregnation process. Defendants' processes involve the use of a plastic layer immediately outside the felt layer which is also impermeable during the impregnation process, and which keeps the resin in the felt during the impregnation process. The function of the impermeable layer is to keep the resin in the felt layer during impregnation. The impermeable plastic layer performs this

function in the claim 1 method performed by the Plaintiff and in the Process 1 and 2 methods performed by the Defendant even though the Defendant has a very thin felt layer on top of their impermeable layer.

40. Defendant has presented evidence to attempt to demonstrate the substantiality of differences between the methods that they use in Processes 1 and 2 and the Plaintiff's method in Claim 1 of the patent to avoid a finding of infringement under the doctrine of equivalents. Defendants describe the substantiality of the differences as follows:

Multiple Cup Process (Process 1)

41. The Multiple Cup Process (Process 1) was based on KM's process used in Europe. It involves a process whereby a quantity of curable resin is introduced inside one end (the upstream end) of an elongated hose-like liner, which has felt as its outermost surface. A plastic layer is sandwiched between the outer felt layer and an inner felt layer. The liner is positioned along a tilted conveyer belt, causing the resin to flow downstream. Slits are formed 10-15 feet apart in the outer felt and plastic layer of the liner. Multiple vacuum cups (typically 4-6) are then positioned over the slits. A vacuum pump is connected to the cups by hoses. The cups apply vacuum simultaneously along the liner, to pull air from the inner felt layer, allowing the flowing resin to evenly soak or impregnate the inner felt.

42. Interruption of vacuum during the process is avoided by using the multiple cups to draw a continuous vacuum beyond the isolated region closest to the resin. The continuous vacuum zone extends approximately 30-50 feet along the liner. When

the cup closest to the resin is removed, the remaining cups positioned farther downstream continue to draw vacuum on the inner felt. The presence of those cups insures that a continuous uninterrupted vacuum is maintained.

Multiple Needle Process (Process 2)

43. The Multiple Needle Process (Process 2) was developed by CAT in 1991 to replace Process 1. In Process 2, multiple hollow needles (typically 4-6), are positioned approximately 10-15 feet apart along the liner. Those needles apply a continuous vacuum to the liner.

44. A quantity of curable resin is introduced inside one end (the upstream end) of the elongated hose-like liner. As in Process 1, the outermost surface of the hose-like liner is made of felt, and the liner is positioned along a tilted conveyer belt, causing the resin to flow downstream.

45. Each needle is used to puncture the liner, such that the needle tip is positioned in the inner felt. The needles are inserted so that they point horizontally in the direction of the resin. Each needle is anchored to the liner, and is connected to the vacuum pump by a hose. When the vacuum pump is activated, the needles draw a vacuum from the inner felt through the tip of the needle. The needles apply vacuum simultaneously along the liner, to pull air from the inner felt layer, allowing the flowing resin to evenly soak or impregnate the inner felt.

46. A continuous uninterrupted vacuum is maintained at all times on the inner felt. When the resin approaches the first needle, that needle is removed and the hole sealed. When that needle is removed, the remaining needles positioned farther

downstream continue to draw vacuum on the inner felt. Interruption of vacuum is avoided, since the needles continue to draw a vacuum beyond the isolated region closest the resin. The continuous vacuum zone extends approximately 30-50 feet along the liner.

Conclusory Findings

47. The Court has considered the evidence of the substantiality of the differences between Plaintiff's patent Claim 1 and the processes used by the Defendants. Defendants' Processes 1 and 2 do not differ substantially from the process disclosed in the '012 patent. They correspond in every detail to claim 1 of the '012 patent, perform the same function (producing effective vacuum at the resin front) by the same means (sequential application of vacuum to the interior of the liner at points along the liner as the liner is moved) and achieve the same result (uniform impregnation of the felt by the resin).

48. Rather than using one cup with a discontinuous vacuum, Process 1 uses multiple cups with a continuous vacuum. The Court has evaluated the substantiality of the differences between Plaintiff's Patent Claim 1 and Process 1. While the addition of more cups prevents a finding of literal infringement, it fails, in this case, to prevent a finding of infringement under the doctrine of equivalents. It is not reasonable for the Defendants to believe that the enhancement of the process by the use of multiple cups results in a substantial difference between Process 1 and the process in Patent Claim 1. Neither is it reasonable for Defendants to have concluded that Inliner relinquished coverage of processes using multiple cups. Defendants' Process 1 is the full equivalent of the process described in claim 1 of the '012 patent. It does the same thing by the same means to accomplish the same result.

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49. Rather than using one cup with a discontinuous vacuum, Process 2 uses multiple needles with a continuous vacuum. The Court has also evaluated the substantiality of the differences between Plaintiff's Patent Claim 1 and Process 2. While the substitution of needles for cups and the addition of multiple needles prevents a finding of literal infringement, it fails, in this case, to prevent a finding of infringement under the doctrine of equivalents. Again, while the needles result in some enhancement in performance, it is not reasonable for the Defendants to conclude that this resulted in a substantial difference between its process and that of the Plaintiff or that Plaintiff relinquished any rights to this type of process. Defendants' Process 2 is the full equivalent of the process described in claim 1 of the '012 patent. It does the same thing by the same means to accomplish the same result. The purpose, function and result of the cup, as claim 1 points out in section (3), is to "prevent(s) ingress of air into the interior of the tube while the tube is being evacuated", which is precisely the purpose, function and result of the needle. Both the cup and the needle are, as claim 1 states, "connected by a flexible hose to a vacuum source", both are the means provided for the application of vacuum, they both do the same thing (suck a vacuum) by the same means (being connected to a vacuum source) to achieve the same result (produce a satisfactory vacuum at the resin front).

50. The vacuum at the resin front when carrying out the multiple-cup Process 1 or multiple-needle Process 2 may be somewhat more efficient, during the time that the vacuum cups are being shifted, however, modification by the addition of multiple cups to the process to create this additional efficiency does not avoid infringement by equivalency because the multiple cups perform the same function in the same way to achieve the same results.

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51. Neither does the substitution of the needle for the cup avoid infringement by equivalency because the mere modification of this feature does not avoid the fact that the basic features of Claim 1 of the patent have been adopted. This new feature performs substantially the same function, in substantially the same way, to achieve substantially the same result. This apparatus distinction is irrelevant in the determination of whether the Defendants' processes infringe under the doctrine of equivalents.

52. There is nothing in the file history of the '012 patent or the prior art which prevents claim 1 from covering Defendants' processes. The patentee originally claimed, in claim 1, all types of vacuum application, and in claim 4 he originally claimed the sequential application of vacuum. The prior art cited by the Examiner did not show that sequential vacuum application, and by amending the claims, the patentee abandoned protection broad enough to include all types of vacuum application but properly retained claims to sequential vacuum application, which is precisely what Defendants do in all of their processes.

53. Because the claims in patent speak to the use of one cup, they result in a discontinuous vacuum. The use of the multiple cup and multiple needle processes result in a continuous vacuum which enhances the degree of vacuum achieved at the resin front. While this enhancement results in an improvement of the process, there is nonetheless an insubstantial difference between Patent Claim 1 and Processes 1 and 2.

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CONCLUSIONS OF LAW

1. The Constitution of the United States authorizes Congress to enact laws to promote the progress of science and useful arts by granting inventors exclusive rights to their inventions for limited periods. These grants, known as "patents", serve the advancement of science because, after the grant period of seventeen (17) years expires, the invention is given to the public for free use by all. As part of the Department of Commerce, the United States Patent and Trademark Office was set up for the purpose of granting patents. It is made up of individuals with technical and legal training whose job it is to carefully review all applications of patents and to issue the patents when appropriate. Because patent examiners have technical and legal expertise, their decisions as to patentability are given great weight. Congress has passed a statute which requires courts to respect the decisions of these experts by resolving doubts as to whether granted patents are valid in favor of the inventor. This is known as the "presumption of validity". United States Constitution, Article I, Section 8, Clause 8; Title 35 United States Code.

2. A patent has one or more claims. The claims measure the invention. Each claim defines a separate, independent invention. *Continental Paper Bag Co. v. Eastern Paper Bag Co.*, 210 U.S. 405, 419, 52 L. Ed. 1112, 28 S. Ct. 748 (1908); *Ballantyne Inst. & Electronics, Inc. v. Wagner*, 345 F.2d, 671 (6th Cir. 1965).

3. Because the patent is presumed valid, to exercise the rights granted by the '012 patent, what the patent owner must do is prove that his patented invention is being used without his permission. This is called infringement. Plaintiff must prove

infringement by a preponderance of the evidence. Once that is proved, the patent owner is then entitled to prevent further unauthorized use of the invention by means of an injunction, and to compensation for past unauthorized use. 35 U.S.C. 271, 283, 284; *Uniroyal, Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 1054 (Fed. Cir. 1988) *cert. denied* 57 U.S.L.W 3281 (1988).

Infringement Generally

4. Whoever without authority makes, uses, or sells any patented invention within the United States during the term of the patent therefor, infringes the patent. 35 U.S.C. § 271. The party who asserts infringement has the burden of proving infringement by a preponderance of the evidence. *Braun, Inc. v. Dynamics Corp.*, 975 F.2d 815, 819 (Fed. Cir. 1992).

5. Infringement can be proved in either one of two ways. One way is by showing literal infringement. If Defendant's method falls clearly within the language of the claims, literal infringement is made out and that is the end of it. *Graver Tank & Mfg. Co. v. Linde Air Products, Co.*, 339 U.S. 605, 607, 94 L. Ed. 1097, 70 S. Ct. 854 (1950).

6. One may avoid literal infringement by using the essence of an invention, but not duplicating it exactly. To overcome this problem, and preserve to inventors what is rightfully theirs, it is well settled that even if there is no literal infringement, one can infringe if one employs a step or steps which are equivalent to those steps in the patent claim which are not met exactly. This rule, called the "doctrine of equivalents" prevents infringers from beating the system by making insignificant changes in the process to avoid literal infringement. *Graver Tank & Mfg. Co. v. Linde Air Products Co.*, 339 U.S. 605, 607,

94 L. Ed. 1097, 70 S. Ct. 854 (1950); *Corning Glass Works v. Sumitomo Elec. USA, Inc.*, 68 F.2d 1251, 1258 (Fed. Cir. 1989). *Laitram Corp. v. Cambridge Wire Cloth Co.*, 863 F.2d 855, 856-7 (1988).

7. This case involves process claims. Equivalency is made out if the steps of Defendants' accused processes are either the same as the Plaintiff's claim (literal infringement) or the Defendants' processes perform substantially the same function as the corresponding step set forth in the claim in substantially the same way to obtain substantially the same result. *Pennwalt Corp. v. Durand-Wayland Inc.*, 833 F.2d 931, 934 (Fed. Cir. 1987). This is known as infringement by equivalents. Something is "equivalent" if it does not substantially change the way in which the function of the claimed invention is performed. *Pennwalt*, at p. 935. A process may be found to be equivalent if after considering the substantiality of the claimed differences in the new process, the fact finder can conclude that the new process represents an insubstantial change. *Hilton Davis Chemical Co. v. Warner-Jenkinson Co.*, No. 93-1088, 1995 U.S. App. LEXIS 21069 (Fed. Cir. August 8, 1995) (per curiam).

8. The issue of equivalency is a question of fact. *Durango Associates Inc. v. Reflange Inc.*, 843 F.2d 1349, 1357 (Fed. Cir. 1988); *Uniroyal Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 1057 (Fed. Cir. 1988); *Hartness International Inc. v. Simplimatic Engineering Co.*, 819 F.2d 1100, 1110 (Fed. Cir. 1987).

9. In accordance with equitable principles, for infringement to exist under the doctrine of equivalents an accused method must perform substantially the same function, in substantially the same way, to achieve substantially the same

result as the invention defined by the claims. *Graver Tank & Mfg. Co. v. Linde Air Products Co.*, 339 U.S. 605, 608, 94 L.Ed. 1097 (1950).

10. To properly apply the *Graver Tank* "function-way-result" test, the function, way and result of each accused process (Process 1 and Process 2) are compared to the function, way and result of the method claimed in the '012 patent. *Malta v. Schulmerich Carillons, Inc.*, 952 F.2d 1320, 1327 (Fed. Cir. 1991); *Lear Siegler, Inc., v. Sealy Mattress Co. of Mich.*, 873 F.2d 1422, 1425-26 (Fed. Cir. 1989).

11. If the evidence shows that even one of these conditions is not satisfied, there can be no infringement by equivalents. *London*, 946 F.2d at 1539; *Johnston v. IVAC Corp.*, 885 F.2d 1574, 1581 (Fed. Cir. 1989); *Lear Seigler*, 873 F.2d at 1581.

12. Each of the three components (function-way-result) must be separately met. *Universal Gym Equip., Inc. v. ERWA Exercise Equip. Ltd.*, 827 F.2d 1542, 1548 (Fed. Cir. 1987). Defendants' Process 1 and Process 2 perform substantially the same function and achieve substantially the same results in substantially the same way as the method claimed in the '012 patent.

13. The doctrine of equivalents is subservient to the doctrine of prosecution history estoppel. *Uniroyal, Inc. v. Rudkin-Wiley Corp.*, 939 F.2d 1540, 1544 (Fed. Cir.), *reh'g denied*, (1991). Prosecution history estoppel limits the doctrine of equivalents. *Charles Greiner*, 962 F.2d at 1036. Prosecution history estoppel is an equitable tool for determining the permissible scope of patent claims. *Mannesmann DeMag Corp v. Engineered Metal Products Co.*, 793 F.2d 1279, 1284-85 (Fed. Cir. 1986).

14. Although the prior art also limits equivalents, prosecution history estoppel and the prior art are separate and distinct concepts. The limits on equivalency imposed by prosecution history estoppel can be, and frequently are, broader than those imposed by the prior art. *Haynes Intern., Inc. v. Jessup Steel Co.*, 8 F.3d 1573, 1579 (Fed. Cir. 1993), *modified on reh'g*, 15 F.3d 1275 (Fed. Cir. 1994). In this case, the issue is whether prosecution history estoppel limits the doctrine of equivalents.

15. Prosecution history estoppel limits a patentee's reliance on the doctrine of equivalents by preventing him from contending later in an infringement action that his claims should be interpreted as if limitations added by amendment were not present. *Jonsson v. Stanley Works*, 903 F.2d 812, 821 (Fed. Cir. 1990).

16. Under the doctrine of prosecution history estoppel, where a patent applicant cancels a claim in the Patent Office to distinguish his invention from prior art, and replaces that claim with another claim, the patent owner is deemed to have surrendered the subject matter covered by the original claim, and cannot recapture that subject matter through the doctrine of equivalents. *Haynes*, 8 F.3d at 1577-78; *Wang Laboratories, Inc. v. Toshiba Corp.*, 993 F.2d 858, 868 (Fed. Cir. 1993); *Charles Greiner*, 962 F.2d at 1036; *Diversitech Corp. v. Century Steps, Inc.*, 850 F.2d 675, 681 (Fed. Cir. 1988). There is no surrendered subject matter under the facts of this case.

17. The legal standard for determining what subject matter was surrendered is an objective one, measured from the vantage point of what a competitor was reasonably entitled to conclude, from the prosecution history, that the application gave up to procure issuance of the patent. *Haynes*, 8 F.3d at 1577-78.

18. Whether or not estoppel exists is a question of law, *Wang Laboratories Inc. v. Toshiba Corp.*, 993 F.2d 858, 867 (Fed. Cir. 1993), and is determined in the context of the entire prosecution history of the patent — the prior art, the Examiner's rulings and the patentee's arguments. In *Wang*, 993 F.2d at 858, when the original claims (for a circuit board with memory chips) were rejected as being unpatentable in view of prior art, the applicant cancelled those claims, replacing them with new claims that required the memory chips to be "mounted in a single row." *Id.* at 867. Those claims eventually issued as part of the patent. The Defendants' accused devices ("lateral memory modules") had *two rows* of memory chips and therefore lacked the very limitation added by amendment (memory chips "mounted in a single row"). The district court permitted the jury to find infringement by equivalents. The Federal Circuit reversed. The court held that "prosecution history estoppel should have been applied to reach the conclusion that the accused lateral memory modules were surrendered during prosecution and therefore do not infringe under the doctrine of equivalents." *Id.* at 868. Even though the specific accused lateral memory modules were not cited prior art during prosecution, the Federal Circuit held that coverage of those devices was surrendered. *Id.* at 867-68.

19. The facts of the present case are distinguishable from the facts in *Wang*. In *Wang*, estoppel was found because in that case the patentee, in arguing to the Examiner, stressed the significance of mounting chips "only in a single row" and that limitation was added to the claims. There estoppel was found excluding multiple row mounting as antiethical to the arguments presented to the Examiner. Similarly in *Charles Greiner & Co. Inc. Marri-Med Mfg. Inc.*, 962 F.2d 1031 (Fed. Cir. 1992), the applicant during prosecution of the patent added to the claims

the recitation that certain elements were located "only" at a particular location. Since in the accused device there was a different location, estoppel was found. There is nothing corresponding to that in this case.

20. When originally presented but abandoned claims contained limitations in dispute with respect to the applicability of the doctrine of equivalents, as is the case here, that is an important factor indicating the lack of applicability of the estoppel doctrine to those limitations. *Insta-Form Products Inc. v. Universal Foam Systems Inc.*, 906 F.2d 698, 703 (Fed. Cir. 1990):

> For the reason that the allowed claim contains the same limitation regarding the connection between the trigger and plunger means as did the abandoned claim, the patent applicant did not disclaim anything relating to the manner by which the plunger and trigger are connected.

See also LaBounty Mfg., Inc. v. U.S. International Trade Commission, op cit. *supra.*

21. In view of the facts in this case the doctrine of prosecution history estoppel is not available to Defendants.

22. Defendants' single-cup process as described in Finding of Fact 29 does not infringe claim 1 of the '012 patent, under the doctrine of equivalents.

23. Defendants' Process 1 infringes claim 1 of the '012 patent under the doctrine of equivalents.

Appendix B

24. Defendants' Process 2 infringes claim 1 of the '012 patent under the doctrine of equivalents.

25. Plaintiffs are entitled to an injunction against the carrying out by the Defendants of any of the infringing processes here dealt with and from carrying out any other impregnation process which infringes those claims.

26. The Court's previous injunction entered on December 1, 1995, Instrument No. 253, will remain in force together with the subsequently issued order addressing enforcement of that injunction, Instrument No. 305.

Signed this 27th day of December, 1996.

s/ Vanessa D. Gilmore
VANESSA D. GILMORE
UNITED STATES DISTRICT JUDGE

APPENDIX C — EXCERPTS OF TESTIMONY OF MR. SMITH

[commencing at page 165]

SMITH – DIRECT JAMES

* * *

Q. NOW YOU'VE BEEN INFORMED BEFORE YOU CAME HERE TODAY AND ALSO WHAT YOU HEARD YESTERDAY, THAT IN THEIR CURRENT PROCESS, INLINER USES NEEDLES RATHER THAN VACUUM CUPS?

A. YES.

Q. WOULD YOU COMPARE THE ACTIONS AND EFFECTIVENESS OF THE VACUUM CUPS AND THE NEEDLES AS USED IN A WET-OUT?

A. YES.

MR. GOLDSTEIN: OBJECTION, YOUR HONOR. THERE'S NO FOUNDATION FOR THIS WITNESS HAVING ANY KNOWLEDGE, OR EVER SEEING NEEDLES IN USE, OR ANYTHING LIKE THAT, SO THERE'S NO FOUNDATION FOR THAT QUESTION WHATSOEVER.

THE COURT: SUSTAINED.

BY MR. JAMES:

Q. DO YOU HAVE AN OPINION, BASED UPON YOUR KNOWLEDGE IN THE FIELD, AS TO HOW THE NEEDLES FUNCTION IN A WET-OUT?

MR. GOLDSTEIN: SAME OBJECTION, YOUR HONOR. HE'S NEVER SEEN IT, I DON'T BELIEVE.

THE COURT: I'M GOING TO LET HIM ANSWER THAT QUESTION.

[166] THE WITNESS: I'M SORRY. COULD YOU JUST REPEAT THAT QUESTION?

BY MR. JAMES:

Q. DO YOU HAVE AN OPINION —

A. YES.

Q. — AS TO HOW THE NEEDLES FUNCTION IN A WET-OUT?

A. YES.

Q. AND WHAT IS THAT OPINION?

THE COURT: NO. YOU NEED TO LAY A PREDICATE. WHAT HIS OPINION IS BASED ON.

BY MR. JAMES:

Q. WHAT IS YOUR OPINION BASED ON?

A. I HAVE DONE SOME EXPERIMENTS USING NEEDLES SINCE WE HEARD OF THIS PROCESS TO COMPARE THEIR EFFECTIVENESS WITH A VACUUM CUP.

Appendix C

Q. AND ON THE BASIS OF THAT, WHAT IS YOUR ANSWER TO MY EARLIER QUESTION?

A. MY EXPERIMENTS SHOWED THAT A NEEDLE WITH A QUARTER INCH DIAMETER IS ABOUT AS EFFECTIVE AS A VACUUM CUP AT REMOVING THE AIR. AT LESS THAN A QUARTER INCH IT IS LESS EFFECTIVE.

* * *

[236] SMITH – CROSS (GOLDSTEIN)

Q. NOW, WHEN DID YOU START EXPERIMENTING WITH NEEDLES, MR. SMITH?

A. IT DEPENDS HOW YOU DEFINE A NEEDLE. I ACTUALLY DID SOME EXPERIMENTS ABOUT THREE YEARS AGO IN NORTHAMPTON WITH A HALF-INCH DIAMETER TUBE, SHARPENED ON ONE END, WHICH IS VERY SIMILAR TO THE QUARTER-INCH DIAMETER NEEDLE, BUT THE ACTUAL EXPERIMENTS WITH THE NEEDLE I DID AFTER WE BECAME AWARE THAT THAT IS THE WAY THAT YOU APPLY THE VACUUM.

Q. AND HAVE YOU DONE ANY EXPERIMENTAL WORK WITH NEEDLES THAT YOU ARE WILLING TO REPORT TO THE COURT?

A. YES.

Q. DO YOU HAVE ANY PAPERWORK WITH YOU?

A. I HAVEN'T GOT ANYTHING WITH ME.

Appendix C

MR. JAMES: I HAVE SOMETHING, IF YOU'LL WAIT JUST A MOMENT.

MR. GOLDSTEIN: YOUR HONOR, I'D CERTAINLY LIKE THE OPPORTUNITY TO LOOK AT THIS DURING THE LUNCH BREAK.

THE COURT: WHY DON'T YOU ALL DO THAT.

* * *

[239] BY MR. GOLDSTEIN:

Q. NOW, JUST BEFORE THE LUNCH BREAK, MR. SMITH, MR. JAMES GAVE ME A COPY OF A THREE-PAGE DOCUMENT, WHICH WE HAVE NOW PHOTO DUPLICATED, WHICH IS ENTITLED, VACUUM APPLICATION TO THE CUP. IS THIS SOMETHING THAT YOU DEVELOPED, SIR?

A. YES.

Q. AND YOU CONCLUDED HERE THAT THE CUP AND —

THE COURT: EXCUSE ME. THE WITNESS DOES NOT HAVE A COPY.

MR. GOLDSTEIN: I'M SORRY.

THE WITNESS: THANK YOU.

Appendix C

BY MR. GOLDSTEIN:

Q. YOU CONCLUDED THERE THAT THE CUP AND WHAT YOU CALLED A TUBE EVACUATED A LINER OR TUBE WITH EQUAL EFFICIENCY, CORRECT?

A. YES.

Q. THIS WAS NOT DONE IN AN IMPREGNATION PROCESS, WAS IT?

A. NO.

Q. IT WAS JUST A SHORT PIECE OF FELT THAT WAS CLAMPED AT BOTH ENDS, THAT YOU JUST MEASURED HOW EFFECTIVE EACH WAS IN WITHDRAWING AIR FROM THE FELT?

A. THAT'S CORRECT.

Q. DID YOU DO ANY EXPERIMENTAL WORK IN WHICH YOU USED A [240] NEEDLE OR WHAT YOU CALL A TUBE IN AN ACTUAL IMPREGNATION?

A. NO.

Q. NEVER DONE THAT?

A. NO.

MR. GOLDSTEIN: YOUR HONOR, I WOULD ASK THAT THE THREE-PAGE DOCUMENT BE MARKED AS EXHIBIT 36 AND I OFFER IT INTO EVIDENCE.

Appendix C

THE COURT: ALL RIGHT.

MR. JAMES: NO OBJECTION.

THE COURT: ALL RIGHT. DX 36 WILL BE ADMITTED.

* * *

[251] SMITH – REDIRECT (JAMES)

Q. NOW, I WANT TO REFER YOU TO THE VACUUM APPLICATION TUBE VERSUS CUP MEMORANDUM — REPORT, RATHER, THAT YOU DID, DEFENDANT'S EXHIBIT 36. THE NEXT TO THE LAST SENTENCE OF THE PORTION ENTITLED "TEST METHOD" READS, QUOTE, THE POINT OF ENTRY OF THE TUBE THROUGH THE COATING WAS SEALED WITH PUTTY TO PREVENT AIR INGRESS.

WHAT DOES THAT REFER TO?

A. WELL, THIS WAS TO GIVE THE TUBE THE MAXIMUM EFFECT. WHEN YOU PUSH IN A TUBE THROUGH A COATING YOU MAKE ESSENTIALLY A SLIT WHICH OPENS AROUND THE NEEDLE AND IT'S NOT ABSOLUTELY — AN ABSOLUTE SEAL ON THE EDGES WHERE THAT SLIT IS BEING MADE, AND SO, BASICALLY, POSTER PUTTY WAS USED TO SEAL THAT AND PRESS DOWN ON IT SO THAT I COULD MEASURE THE TRUE EVACUATION RATE FROM THE NEEDLE WITHOUT ANY AIR LEAKING BACK IN AGAIN.

Appendix C

Q. AND WHAT WOULD HAVE BEEN THE EFFECT ON YOUR MEASUREMENTS HAD YOU NOT DONE THAT?

A. I DON'T KNOW.

* * *

[556] SMITH – DIRECT (JAMES)

Q. NOW, SIR, WOULD YOU COMPARE THE CONDITION OF THE LINER IN ADVANCE OF THE RESIN FRONT AS YOU SAW IT ON THIS INLINER VIDEO TAPE AND AS IT IS SHOWN ON THE INSITUFORM VIDEO TAPE.

A. THEY BOTH LOOKED SIMILAR IN THAT THEY ARE SQUASHED FLAT BY HAVING A VACUUM IN.

Q. DO YOU HAVE AN OPINION AS TO THE RELATIVE EXCELLENCE OF THE IMPREGNATION THAT WAS CARRIED OUT IN THE INSITUFORM TAPE AND THE INLINER TAPE?

A. I HAVE NO REASON TO THINK THERE'S ANY DIFFERENCE.

* * * *

Appendix C

[DEFENDANT'S TRIAL EXHIBIT 36]

VACUUM APPLICATION – TUBE V. CUP

INTRODUCTION

This report describes a test made to compare the efficiency of application of a vacuum to a tube in the manner described by CAT Contracting with the method used for many years by Insituform® installers. The CAT Contracting method is to pierce the coating with a "needle" variously described as having a bore diameter of 1/8th to 1/4 inch and approximately 6 inches long. The "needle" is connected to a vacuum hose. In US Patent No. 4,366,012 the traditional method of using a vacuum cup is described.

TEST METHOD

An Insitutube™ of nominal 10 inch diameter by 7.5 mm. thick, 18 feet long was sealed at both ends. Vacuum gauges were attached at each end to indicate the pressure inside the tube at those positions. Vacuum was applied at one end by the vacuum cup method and the pressures were recorded with time. The cup was removed and air allowed to re-enter the tube until both gauges indicated atmospheric pressure. The slit in the tube was sealed and then vacuum was re-applied through a 3/16ths inch diameter (bore) steel tube, 6 inches long. The point of entry of the tube through the coating was sealed with putty to prevent air ingress. Again the pressure variation with time was recorded.

RESULTS

The results of the measurements are tabulated below and are shown graphically in Figure 1.

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TIME – SECONDS	PRESSURE AT CUP END millibar	PRESSURE AT FAR END millibar	PRESSURE AT NEEDLE END – millibar	PRESSURE AT FAR END millibar
30	265	635	465	750
60	185	435	285	535
90	145	340	210	415
120	125	295	185	340
150	115	275	160	305
180	115	255	145	290
210	110	245	135	275
240	110	235	130	260

DISCUSSION

It can be seen that the rate of evacuation of the tube was slightly slower with the "needle" than with the cup but a shorter "needle" or one of slightly increased diameter would give flow rates which would be similar to those obtained with the cup.

Appendix C

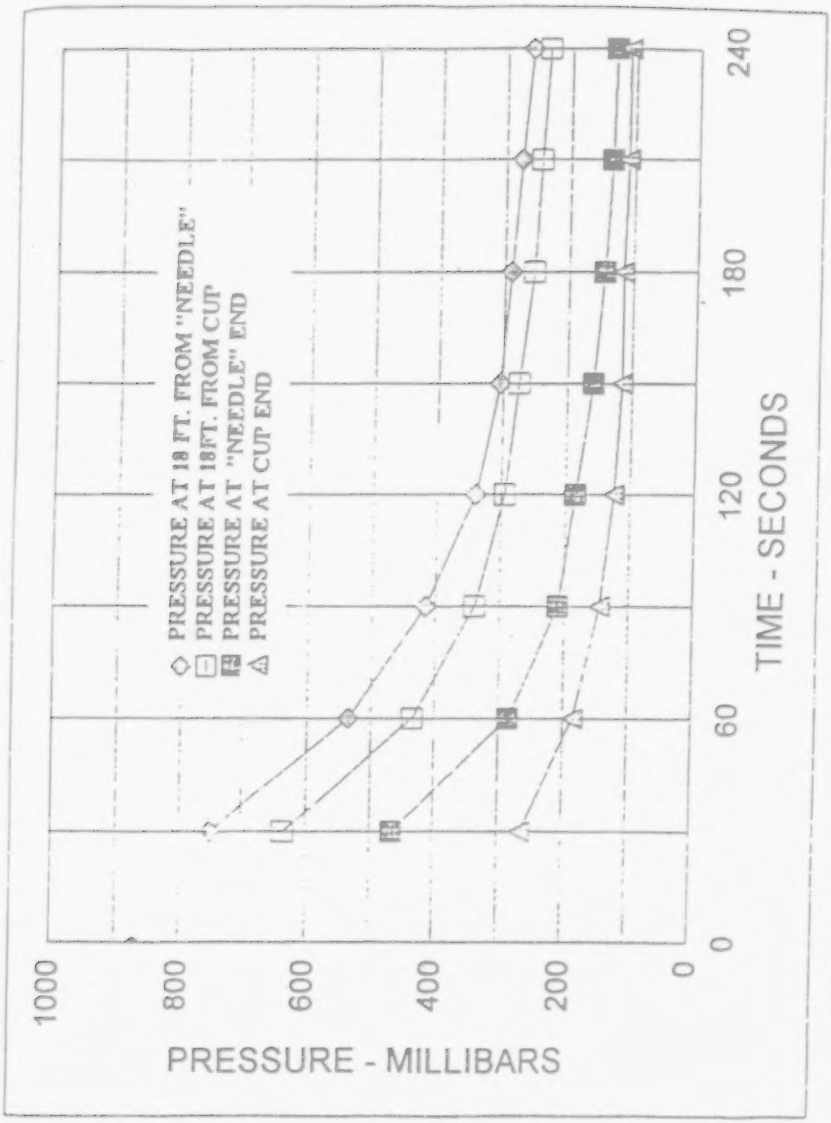

FIGURE 1 COMPARISON OF EVACUATION BY CUP OR "NEEDLE"

Appendix C

CONCLUSIONS

Provided the "needle" is of sufficient diameter it will achieve the same evacuation rate as the vacuum cup method. The size of the hole needed in the coating is similar for both methods.

E. P. SMITH
23 January 1995

APPENDIX D — EXCERPTS OF TESTIMONY OF MR. CATALLO

[commencing at page 85]

CATALLO – DIRECT (JAMES)

* * *

Q. WELL, I SHOW YOU THE '012 PATENT. I ASK YOU TO LOOK AT THE PART NUMBERED 3 OF CLAIM 1.

A. I'M SORRY, MR. JAMES. WHAT PART?

Q. THREE.

* * *

[86] MR. JAMES: SECTION 3 OF CLAIM 1, AND MY QUESTION WILL BE, ISN'T THAT WHAT YOUR CUPS DID?

* * *

BY MR. JAMES:

Q. ISN'T THAT WHAT YOUR CUPS DO?

* * *

[87] NO, SIR, WE DON'T DO — WE DIDN'T DO THAT.

BY MR. JAMES:

Q. WHAT WAS IT THERE THAT YOU DIDN'T DO?

Appendix D

A. WE DIDN'T DO TWO THINGS. IT SAYS, DRAW THROUGH A WINDOW A VACUUM IN THE INTERIOR OF THE TUBE. WE DIDN'T HAVE A WINDOW. WE HAD A SLIT. WE HAD AN X.

AND THEN IT SAYS OF ONE END, BY PLACING OVER THE WINDOW A CUP CONNECTED BY A FLEXIBLE HOSE TO A VACUUM SOURCE, WHICH CUP PREVENTS INGRESS AIR INTO THE INTERIOR OF THE TUBE WHILE THE TUBE IS BEING EVACUATED, THE OTHER LAYER OF THE TUBE BEING SUBSTANTIAL, IMPERMEABLE TO AIR.

OUR OTHER LAYER IS IMPERMEABLE TO AIR. OUR OTHER LAYER WAS FELT. AND THE VACUUM CUP DIDN'T SEAL COMPLETELY BECAUSE SOME AIR DID GET THROUGH THE VACUUM CUP, BECAUSE WE HAVE THE FELT THAT'S BETWEEN THE FILM AND THE SUCTION CUP. THERE'S FELT THERE. SO IT DIDN'T COMPLETELY SEAL.

Q. AND THE FACT THAT IT DIDN'T COMPLETELY SEAL WAS SOMETHING BAD, WASN'T IT?

A. THAT'S CORRECT.

* * *

[88] BY MR. JAMES:

Q. NOW, IN YOUR NEEDLE PROCESS, PROCESS 2, WHAT DOES THE NEEDLE DO?

Appendix D

A. THE NEEDLE PUNCTURES THROUGH THE FELT AND DRAWS VACUUM [89] FROM THE MIDDLE OF THE TUBE.

Q. PUNCHES THROUGH THE FELT?

A. YES.

Q. TELL ME ABOUT THAT.

A. WELL, WE TAKE THE NEEDLE AND WE PUNCTURE THROUGH THE FIRST LAYER OF FELT. WE PUNCH IT THROUGH THE FILM AND THEN WE PUNCH IT THROUGH THE NEXT LAYER OF FELT AND IT GOES INTO THE CENTER OF THE TUBE IN ORDER TO EVACUATE THE AIR.

Q. NOW, THE PLASTIC LAYER THAT THIS NEEDLE IS GOING THROUGH, BEFORE THE NEEDLE GETS TO IT, THAT PLASTIC LAYER IS IMPERMEABLE, IS IT NOT?

A. YES, SIR, IT IS.

Q. AND AFTER THE NEEDLE GOES THROUGH IT, IS IT STILL IMPERMEABLE?

A. YES.

Q. AIR DOESN'T GET THROUGH?

A. WELL, IT GETS THROUGH THE NEEDLE.

Q. AND HOW DOES IT MANAGE THAT?

A. WELL, BECAUSE THE NEEDLE HAS PUNCTURED THROUGH.

Q. IT'S MADE A HOLE?

A. THAT'S CORRECT.

Q. A WINDOW?

A. NO.

Q. NOT A WINDOW BUT A HOLE?

A. IF IT WAS A WINDOW IT WOULDN'T BE ABLE TO DRAW VACUUM [90] BECAUSE IT WOULD SUCK AIR FROM THE WINDOW.

Q. YOU'RE DISTINGUISHING BETWEEN A WINDOW AND A HOLE, IS THAT WHAT YOU MEAN?

A. OF COURSE, YES. YES, SIR. IF I WOULD HAVE CUT A WINDOW —

Q. SIR, YOU'VE ANSWERED MY QUESTION.

A. AND I —

THE COURT: SIR, WAIT FOR A QUESTION.

THE WITNESS: I'M SORRY, MA'AM. I'M SORRY, YOUR HONOR.

Appendix D

BY MR. JAMES:

Q. NOW, WHEN YOU PUT THE NEEDLE IN, WHAT IS THE RELATIONSHIP BETWEEN THAT NEEDLE AND THE IMMEDIATELY SURROUNDING PORTION OF THE IMPERMEABLE PLASTIC LAYER?

A. I'M SORRY, MR. JAMES. I DON'T UNDERSTAND.

Q. YOU PUT THE NEEDLE THROUGH, YES? YOU PUNCHED YOUR HOLE?

A. YES, SIR.

Q. WHAT IS THE RELATIONSHIP BETWEEN THE OUTER SURFACE OF THAT NEEDLE AND THE INNER SURFACE OF THAT HOLE?

A. THE RELATIONSHIP IS THAT THAT HOLE IS SQUEEZING DOWN ON THE NEEDLE.

Q. SO NO AIR GETS IN AROUND THE NEEDLE?

A. IT GETS SOME AIR AROUND THE NEEDLE, BUT NOT A LOT. NO.

Q. AND THE DEGREE TO WHICH AIR DOES COME AROUND THE NEEDLE, THAT'S BAD, ISN'T IT?

[91] A. YES.

Q. SO WHAT YOU'RE DOING WITH THE NEEDLE IS DOING THE BEST YOU CAN WITH THE NEEDLE TO PREVENT AIR FROM GETTING INTO THE FELT, RIGHT?

A. NO. WHAT I'M DOING WITH THE NEEDLE — I MEAN THE REASON WE'RE DOING WITH THE NEEDLE IS SO IT DOESN'T FALL OFF THE MATERIAL AND IT EVACUATES THE AIR BETTER.

Q. BUT IN TERMS OF THE RELATIONSHIP BETWEEN THE NEEDLE AND THE IMPERMEABLE LAYER, WHAT YOU'RE DOING IS DOING YOUR BEST TO GET A SEAL AROUND THE NEEDLE SO NO AIR GETS THROUGH, RIGHT?

A. I MEAN, IT'S JUST HOW IT WORKS, MR. JAMES. I'M NOT DOING ANYTHING. IT'S JUST PUNCHING IT THROUGH THE FILM.

Q. AND WHEN YOU PUNCH IT THROUGH THE FILM —

A. IT CREATES A SEAL BETWEEN THE FILM AND THE NEEDLE. OKAY? YES, SIR.

Q. NOW, LOOK AGAIN AT THIS, AT THIS SECTION 3 OF CLAIM 1, AND TELL ME, PLEASE, WHAT IT IS THAT YOU DON'T DO, IF ANYTHING, WHEN YOU'RE USING THE NEEDLES?

A. I DON'T HAVE A WINDOW. IT SAYS DRAWING THROUGH THE WINDOW. I'M NOT DRAWING THROUGH THE WINDOW.

Q. YOU'RE DRAWING THROUGH THE HOLE?

A. WELL, I'M DRAWING FROM THE NEEDLE.

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Q. WHICH MADE THE HOLE?

A. THE NEEDLE THAT MADE THE HOLE. YES, SIR. BUT I'M ACTUALLY DRAWING FROM WITHIN THE TUBE. I'M NOT DRAWING FROM [92] OUTSIDE THE TUBE.

Q. ALL RIGHT.

A. I'M NOT DOING A WINDOW. I'M NOT DEPOSITING A CUP OVER THE WINDOW. I DON'T HAVE A CUP PREVENTING THE INGRESS OF AIR INTO THE INTERIOR.

Q. YOU HAVE A NEEDLE PREVENTING THE INGRESS OF AIR, DON'T YOU?

A. YES.

Q. OKAY.

A. AND I DON'T HAVE AN IMPERMEABLE OUTER LAYER.

Q. WHAT DO YOU HAVE OUTER LAYER, JUST OUTSIDE THE FELT?

A. MR. JAMES, I'M SORRY. COULD YOU REPEAT THE QUESTION?

Q. WHAT DO YOU HAVE AS AN OUTER LAYER JUST OUTSIDE THE FELT?

A. THE INTERNAL FELT?

Q. YES.

A. WELL, WE HAVE INTERNAL LAYERS OF FELT. AND THEN WE HAVE A FILM.

Q. THAT'S WHAT I'M TALKING ABOUT?

A. AND THEN WE HAVE AN EXTERIOR FELT.

Q. AND THE FILM, WHAT YOU CALL A FILM, THAT'S IMPERMEABLE, ISN'T IT?

A. THAT'S CORRECT.

Q. AND IT'S THAT FILM THAT YOU PUNCH THE NEEDLE THROUGH THAT'S FORMING A SEAL, MORE OR LESS, AROUND THE NEEDLE, RIGHT?

A. FIRST IT GOES THROUGH THE TOP LAYER OF THE FELT. THEN IT [93] GOES THROUGH THE FILM AND THEN IT GOES THROUGH THE INNER LAYERS OF FELT.

Q. I UNDERSTAND. BUT WHEN IT GOES THROUGH THE OUTER LAYER —

A. YES, SIR.

Q. — THAT'S THE IMPERMEABLE LAYER, ISN'T IT?

A. THAT'S CORRECT.

Q. DO YOU HAVE TO ANCHOR THE NEEDLE TO THE LINER IN ANY WAY?

Appendix D

A. NO, SIR.

Q. HOW BIG IS THE NEEDLE?

A. I THINK IT HAS A QUARTER INCH VOID, QUARTER INCH —

Q. DIAMETER?

A. CANAL, YES.

Q. AND THAT CONNECTS TO A HOSE WHICH GOES TO YOUR VACUUM PUMP?

A. THAT CONNECTS TO A T, TO A CAST IRON T — CAST IRON, TO A STEEL T FIRST.

Q. AND HOW BIG IS THE T?

A. IT'S A HALF-INCH T.

Q. INSIDE THE DIAMETER?

A. I BELIEVE IT'S HALF-INCH.

Q. SO THE NEEDLE IS SMALLER THAN THE — THE INSIDE OF THE NEEDLE IS SMALLER THAN THE INSIDE OF THE T?

A. THAT'S RIGHT.

Q. WHEN YOU USED CUPS, CUPS CONNECTED TO A PIPE TUBE THAT WENT TO THE PIPE, RIGHT?

[94] A. THAT'S CORRECT.

Q. HOW BIG WAS THE TUBE IN TERMS OF DIAMETER?

A. ABOUT THE SAME. ABOUT — I BELIEVE IT'S ABOUT A HALF-INCH COPPER.

Q. NOW, YOU'VE TALKED TO US ABOUT THAT OUTER FELT LAYER, OUTERMOST FELT LAYER. HOW THICK IS IT?

A. PARDON ME?

Q. HOW THICK IS IT?

A. IT'S ABOUT ONE MILLIMETER.

Q. AND YOU'VE TOLD US, I THINK, THAT IT'S A DISADVANTAGE WITH THE CUPS BECAUSE IT'S HARD TO GET A SEAL?

A. THAT'S CORRECT.

Q. THAT'S WHY YOU WENT TO THE NEEDLES, RIGHT? THAT'S WHY YOU WENT TO THE NEEDLES?

A. ONE OF THE REASONS.

Q. ONE OF THE MAIN REASONS?

A. I THINK THE MAIN REASON IS THAT THE NEEDLES EVACUATE BETTER.

Appendix D

Q. DO ALL OF YOUR INSTALLATIONS HAVE THAT OUTERMOST FELT LAYER?

A. YES, SIR.

* * *

[111] Q. NOW, IF WE TURN TO THE NEEDLE PROCESS, PROCESS 2, HOW DOES THAT PROCESS DIFFER FROM PROCESS 1 EXCEPT, WITH THE USE OF A NEEDLE RATHER THAN A VACUUM CUP?

A. WELL, WE REMOVE A STEP. WE DON'T HAVE TO CUT THE SLITS. WE JUST TAKE THE NEEDLE AND WE PUT IT INTO THE FELT, INTO THE TUBE. THAT'S DIFFERENT.

WE EVACUATE THE TUBE FROM WITHIN WITH AIR. WE DON'T DRAW AIR THROUGH THE MEMBRANE. WHEN THE NEEDLE — IF YOU COULD IMAGINE A BOX WITH A NEEDLE STICKING IN THE MIDDLE OF IT, THE AIR IS MUCH MORE ACCESSIBLE AND IT CAN GO THROUGH THE NEEDLE EASIER. THAT'S DIFFERENT.

I MEAN, THE NEEDLE DON'T DETERIORATE. THE NEEDLES PUNCTURE THROUGH THE FIRST FELT, THROUGH THE MEMBRANE, AND THEY PUNCTURE THROUGH THE OTHER LAYERS OF FELT IN ORDER TO GET TO THE MIDDLE TUBE IN ORDER TO EVACUATE. AND EVACUATION IS MORE EFFICIENT.

Q. WHEN YOU PUT THE NEEDLE IN, DOESN'T THE ACT OF PUTTING THE NEEDLE IN FORM AN OPENING IN THE IMPERMEABLE LAYER?

A. IT PUNCTURES IT, YES, SIR.

Q. YOU SAY IT PUNCTURES IT. DOESN'T IT FORM A HOLE IN IT?

[112] A. YES.

Q. AND YOU THINK THAT'S DIFFERENT FROM A WINDOW?

A. MUCH DIFFERENT, YES, SIR.

* * * *

APPENDIX E — EXCERPTS OF TESTIMONY OF MR. HARMON

[commencing at page 482]

HARMON – DIRECT (ELLIOTT)

* * *

AND, ANYWAY, TO COMPLETE MY ANSWER THERE, I CONCLUDED, AND I'VE HEARD TESTIMONY THROUGHOUT THIS TRIAL THAT CONFIRMS THAT, THAT NEEDLES ARE IN NO WAY EQUIVALENT TO CUPS IN THE SENSE OF HOW THEY ACCOMPLISH THE FUNCTION THAT'S REQUIRED IN THIS METHOD.

Q. AND DID YOU COMPARE NEEDLES WITH MULTIPLE CUPS OR WITH ONE CUP?

A. I COMPARED, ACTUALLY, BOTH. I COMPARED IT WITH — FIRST, I COMPARED NEEDLES WITH A SINGLE CUP PROCESS AS CLEARLY SHOWN IN THE PATENT.

BUT THEN I TOOK IT A STEP FURTHER AND ASSUMED — WELL, LET'S GIVE PLAINTIFF'S EVERY BENEFIT OF EVERYTHING THAT THEY'RE ASKING FOR, AND ASSUME THAT THE PATENT COVERS MULTIPLE CUPS, WHICH IT DOESN'T, BUT I ASSUMED THAT, AND I COMPARED MULTIPLE NEEDLES WITH MULTIPLE CUPS. AND I FOUND IMPORTANT DIFFERENCES. AT LEAST THEY SEEM IMPORTANT TO ME AND I'VE HEARD TESTIMONY THAT THEY'RE IMPORTANT.

Q. DID YOU COMPARE THE FUNCTION OF MULTIPLE NEEDLE PROCESS WITH THE FUNCTION —

Appendix E

THE COURT: EXCUSE ME, MR. ELLIOTT. I NEED TO UNDERSTAND.

[483] TELL ME WHAT THE IMPORTANT DIFFERENCES WERE.

THE WITNESS: YOUR HONOR, THERE ARE SEVERAL. AND PERHAPS YOU CAN SEE THIS WHEN YOU WATCH THE VIDEO.

THE COURT: WELL, WHY DON'T YOU USE THE CUP AND THE NEEDLE AND SHOW ME WHAT THE IMPORTANT DIFFERENCES ARE TO CONSIDER.

THE WITNESS: YES. I'M AFRAID OF THAT NEEDLE.

FOR ONE THING, THIS CUP IS RUBBER, AND IT SIMPLY IS GOING TO DETERIORATE OVER A PERIOD OF TIME. THE NEEDLE APPARENTLY DOES NOT DETERIORATE. SO IT HAS A MUCH — IT HAS MUCH LESS MAINTENANCE REQUIRED.

IN THE SECOND PLACE, YOU HAVE TO UNDERSTAND PERHAPS — PERHAPS I OUGHT TO EXPLAIN THIS, FIRST.

THERE IS REALLY A FUNDAMENTAL DIFFERENCE BETWEEN THE PROCESSES THAT ARE USED — FOR EXAMPLE, THE PATENTED PROCESS AND THE INLINER PROCESS — IN THAT THE PATENTED PROCESS IMPREGNATES AND THEN TAKES THAT IMPREGNATED TUBE AND INVERTS IT IN THE PIPE.

Appendix E

THE COURT: OKAY. I'M NOT THERE. I WANT TO DEAL WITH WHAT YOU SAID. YOU KEEP MAKING CONCLUSIONARY STATEMENTS BUT YOU NEVER SAY WHY. YOU SAY THAT —

THE WITNESS: I WILL TRY AND GET TO THAT.

THE COURT: OKAY.

THE WITNESS: BUT I'M NOT SURE IT CAN BE FULLY UNDERSTOOD WITHOUT THIS. I'LL TRY TO DO IT SHORTHAND SO YOU [484] CAN SEE.

THE COURT: MY QUESTION IS THIS: YOU SAID YOU FEEL THAT THE DOCTRINE OF EQUIVALENTS SHOULD NOT APPLY. THE ONLY THING THAT YOU'VE SAID ABOUT THAT SO FAR IS THAT THE NEEDLES ARE NO WAY EQUIVALENT TO THE CUPS IN TERMS OF THEIR FUNCTION. MY QUESTION IS WHY AREN'T THE NEEDLES EQUIVALENT TO THE CUPS?

DON'T TELL ME ABOUT INVERSION AND ALL THAT OTHER STUFF. THAT'S WAY DOWN THE ROAD. TELL ME THE ANSWER TO THIS QUESTION. NEEDLES ARE IN NO WAY EQUIVALENT TO CUPS IN TERMS OF THEIR FUNCTION.

THE WITNESS: WE'VE DISCUSSED MAINTENANCE, DETERIORATION. WE'VE — THE NEXT THING IS THAT A CUP SIMPLY WON'T STAY ON AS WELL AS A NEEDLE, PARTICULARLY WHERE THE SURFACE THAT IT HAS TO STAY ON IS FELT. PERHAPS THE PATENTED METHOD CAN USE CUPS BECAUSE IT USES AN

EXTERIOR FILM. IT'S NOT A SOFT, FUZZY COMPRESSIBLE LAYER THAT WILL LET AIR LEAK IN.

THAT'S NOT WHAT MR. CATALLO DOES. HE HAS AN OUTER LAYER OF FELT.

THE COURT: OKAY.

THE WITNESS: AND THIS CUP JUST WON'T STAY ON THERE.

THE COURT: LET ME ASK YOU THIS: DOES IMPROVEMENT OF EFFICIENCY ALONE MEAN THAT YOU'RE NOT INFRINGING ON A PATENT?

THE WITNESS: IMPROVEMENT OF EFFICIENCY ALONE IS A SIGNIFICANT DIFFERENCE. AND IN THE PARLANCE OF THE DOCTRINE [485] OF EQUIVALENTS, THE ANSWER TO YOUR QUESTION IS, YES, YOU'RE NOT INFRINGING IF IT'S A SIGNIFICANT DIFFERENCE.

THE COURT: SO IMPROVEMENT OF EFFICIENCY IN AND OF ITSELF, IF THAT'S THE ONLY ISSUE, IMPROVEMENT OF EFFICIENCY, THAT WOULD TAKE YOU OUT OF THE REALM OF HAVING INFRINGED; IS THAT WHAT YOU'RE SAYING?

THE WITNESS: IF IT'S ATTRIBUTABLE TO THE DIFFERENT WAY IN WHICH IT'S DONE. IF IT'S ATTRIBUTABLE. I'M NOT SAYING THAT IF YOU ADD SOMETHING TO YOUR PROCESS THAT MAKES IT BETTER, YOU DON'T INFRINGE. THAT'S HORN-BOOK LAW.

Appendix E

BUT IF THE DIFFERENCE BETWEEN THESE TWO THINGS RESULTS IN THIS HAVING IMPROVED EFFICIENCY, THEN IT'S A SIGNIFICANT CHANGE AND THERE'S NO INFRINGEMENT UNDER THE DOCTRINE OF EQUIVALENTS. THEY'RE NOT EQUIVALENT BECAUSE OF THAT.

THE COURT: OKAY.

THE WITNESS: THERE ARE OTHER DIFFERENCES. THE NEEDLE CAN BE IN PLACE AT ANY POINT AROUND THE PERIPHERY OF THE TUBE, WHEREAS THE CUP WOULD HAVE TO SIT LEVEL ON TOP, BECAUSE IT'S PROBABLY NOT GOING TO STICK IF IT SITS ON THE SIDE AS IT MOVES THROUGH. ANY LITTLE JOSTLING MIGHT KNOCK IT OFF THAT WAY.

THE COURT: OKAY.

MR. ELLIOTT: MAY I APPROACH THE WITNESS, YOUR HONOR?

THE COURT: SURE.

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[525] HARMON – CROSS (JAMES)

Q. AND INDEED EVEN WITH THE NEEDLE, IT WOULD SEEM, JUDGING FROM WHAT YOU'VE TOLD US ABOUT THE VIDEOTAPE, EVEN THEN THEY HAVE A PROBLEM WITH LEAKAGE AROUND THE NEEDLE AND SOMETIMES THEY HAVE TO USE TAPE AROUND THE NEEDLE, RIGHT?

A. THAT'S RIGHT. I'M NOT SURE I FULLY UNDERSTAND THAT PROBLEM. BUT I DID SEE THAT AND IT WAS DESCRIBED TO ME THAT WAY. ONCE IN A WHILE, THEY HAVE TO PUT THE NEEDLE THROUGH A PIECE OF TAPE.

Q. AND ISN'T THAT ALSO — IF YOU HAVE CLAIM 1 IN FRONT OF YOU HERE, THE PATENT CLAIM 1 — WELL, I'LL HOLD IT HERE — WHAT WE WERE JUST TALKING ABOUT, THE LEAKAGE AROUND THE OUTSIDE OF THE NEEDLE THAT WE WERE TRYING TO PREVENT, THAT IS THE KIND OF THING THAT IS REFERRED TO IN SECTION 3 OF THE PATENT CLAIM 1, PREVENTS INGRESS OF AIR INTO THE INTERIOR OF THE TUBE WHILE THE TUBE IS BEING EVACUATED?

A. SEALING AROUND THE NEEDLE WOULD ASSIST IN THAT, YES.

Q. THAT'S THE PURPOSE OF THE SEALING, TO TRY TO ACCOMPLISH THAT IN A MORE EFFICIENT MANNER, RIGHT, MORE EFFECTIVE MANNER?

A. AS FAR AS I KNOW.

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APPENDIX F — EXCERPTS OF TESTIMONY OF MR. VADEN

[commencing at page 297]

VADEN – DIRECT (JAMES)

* * *

A. WELL, A LITERAL INFRINGEMENT OF THE CLAIMS WOULD BE THAT THE CLAIMS WOULD READ EXACTLY UPON WHAT HE IS DOING. NOW, IT MAY ALSO BE DIFFERENT FROM THAT WHICH IS SET FORTH IN THE PREFERRED EMBODIMENT SET FORTH IN THE PATENT.

BUT THE CLAIMS ARE MORE GENERIC, ARE BROADER THAN THAT. AND, AS A RESULT, THEY MAY COVER EXACTLY WHAT HE'S DOING. HOWEVER, THAT'S NOT THE END OF THE ANALYSIS BECAUSE UNDER THE DOCTRINE OF EQUIVALENTS, THE PERSON WHOSE ACTIVITY'S UNDER INVESTIGATION MAY ALSO BE TAKING ADVANTAGE OF THE PATENT, SO TO SPEAK; IN OTHER WORDS, PRACTICING THE INVENTION, BUT FALL OUTSIDE OF THE LITERAL SCOPE OF THE LANGUAGE.

AND UNDER THOSE CONDITIONS YOU WOULD HAVE TO INVESTIGATE WHETHER OR NOT HE WAS PERFORMING SUBSTANTIALLY THE SAME FUNCTION AND SUBSTANTIALLY THE SAME WAY TO ACCOMPLISH THE SAME RESULTS, WHICH IS THE TEST FOR THE DOCTRINE OF EQUIVALENTS.

Q. WOULD YOU MIND SAYING THAT AGAIN, THE TEST OF DOCTRINE OF EQUIVALENTS?

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A. YES. IF THE ACTIVITY PERFORMS SUBSTANTIALLY THE SAME FUNCTION IN SUBSTANTIALLY THE SAME WAY TO ACCOMPLISH SUBSTANTIALLY THE SAME RESULT, THEN THAT WOULD BE AN INFRINGEMENT.

* * *

[316] Q. NOW, THE PATENT DISCLOSES, DOES IT NOT, A VACUUM CUP?

A. YES.

Q. AND THE TERM, CUP, IS USED IN THE CLAIM, IS IT NOT?

A. YES, IT IS.

Q. AND THE TERM, CUP, IS USED IN THE SPECIFICATION?

A. YES.

Q. WHAT, IF ANYTHING, DOES THE SPECIFICATION SAY ABOUT THE NECESSITY OF USING A CUP RATHER THAN SOMETHING ELSE?

A. WELL, AGAIN, THE OBLIGATION TO SET FORTH SOME MEANS DOESN'T MEAN IT'S THE ONLY MEANS THAT MAY BE USED. IT SAYS, FOR INSTANCE, IN COLUMN 2 LINE 30, THE VACUUM MAY BE APPLIED. IT DOESN'T SAY IT MUST BE APPLIED OR THIS IS THE ONLY WAY THAT INVENTION CAN BE PRACTICED.

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[317] IT GIVES AN EXAMPLE, A PREFERRED EXAMPLE AT THE TIME. BUT IT SAYS IT USES A CUP — MAY BE APPLIED THROUGH A WINDOW IN THE FILM IN THE WALL OF THE TUBE BY MEANS OF A CUP.

Q. AND LET ME REFER YOU TO COLUMN 6, LINES 1 THROUGH 5, AND ASK YOU WHETHER THEY CAST ANY LIGHT ON WHAT THE PATENTEE SAID THE FUNCTION OF THE CUP WAS?

A. WELL, THE VACUUM THAT IS BEING APPLIED HAS TO BE APPLIED TO THE INTERIOR OF THE LINING TUBE, AND THE CUP ALLOWS THAT TO HAPPEN. IT SAYS THAT THE VACUUM APPLIED TO THE INTERIOR OF THE CUP CAN BE APPLIED TO THE INTERIOR OF THE LINING TUBE.

AND THEN IT SAYS A LITTLE BIT MORE ABOUT HOW THAT'S DONE, WHEREBY AIR IS DRAWN FROM THE INSIDE OF THE TUBE TO PERMIT THE EFFECTIVE AND EFFICIENT IMPREGNATION OF THE ABSORBENT MATERIAL WITH THE RESIN.

Q. WHAT, IF ANYTHING, DOES THE CLAIMS SAY ABOUT THE FUNCTION OF THE CUP?

A. WELL, AGAIN, IN ELEMENT 3 OR PART 3 OF THAT CLAIM 1 IT SAID, DRAWING THROUGH THE WINDOW A VACUUM IN THE INTERIOR OF THE TUBE, DOWNSTREAM OF THE SAID ONE END, BY DISPOSING OVER THE WINDOW A CUP CONNECTED BY A FLEXIBLE HOSE TO A VACUUM SOURCE.

Appendix F

THEN IT GOES ON, WHICH CUP PREVENTS INGRESS OF AIR INTO THE INTERIOR OF THE TUBE WHILE THE TUBE IS BEING EVACUATED.

* * *

[342] Q. WOULD YOU COMPARE THE FUNCTION OF THAT NEEDLE WITH THE FUNCTION OF A SUCTION CUP?

A. WELL, THE FUNCTION OF THE SUCTION CUP ALLOWS THE SOURCE OF THE VACUUM TO BE APPLIED THROUGH THE OPENING, THROUGH THE WINDOW, TO THE INTERIOR LAYER OF THE TUBE, AND THE NEEDLE, SO-CALLED NEEDLE, ALLOWS THE SOURCE OF THE VACUUM TO BE APPLIED THROUGH A WINDOW IN THE TUBE, TO THE INNER LAYER OF THE TUBE. AND THEREFORE I THINK THE FUNCTIONS ARE THE SAME.

Q. WOULD YOU COMPARE THE WAY IN WHICH THE NEEDLE ACHIEVES THAT FUNCTION WITH THE WAY IN WHICH A SUCTION CUP ACHIEVES THAT FUNCTION?

A. WELL, THE WAY THAT IS IMPORTANT TO THE CLAIM IS THE LOCATION, AND THE LOCATION IS NEAR THE FRONT END OF THE RESIN MASS.

WHEN THE CUP IS PLACED THERE TO FORM A VACUUM, IT DRAWS AIR OUT OF THE FRONT END, AND IN THE SAME WAY WHEN THE NEEDLE IS PLACED IN THAT LOCATION, IT ALSO DOES THE SAME. IT PERFORMS IN THE SAME WAY.

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Q. AND WOULD YOU COMPARE, PLEASE, THE RESULT OF USING THE NEEDLE IN THE PROCESS WITH THE RESULT OF USING A SUCTION CUP?

A. WELL, THE RESULT IS THE COMPLETION OF GOOD IMPREGNATION AND APPARENTLY THE RESULTS ARE SATISFACTORY, WHETHER OR NOT YOU USE THE CUP OR THE NEEDLE, AND THEREFORE THEY'RE THE SAME [343] COMPLETE IMPREGNATION OF THE RESIN.

Q. NOW, DO YOU HAVE AN OPINION AS TO WHETHER THE INLINER 2 PROCESS AS A WHOLE PRODUCES SUBSTANTIALLY THE SAME FUNCTION AS THE '012 PATENT PROCESS?

A. YES. THE FUNCTION IS TO DRAW THE AIR OUT OF THE REGION NEAR THE FRONT END OF THE RESIN MASS, AND IT DOES THAT IN SUBSTANTIALLY THE SAME WAY FOR THE NEEDLE PROCESS.

* * *

[344] Q. AND DO YOU HAVE AN OPINION AS TO WHETHER INLINER 2 INFRINGES CLAIM I OF THE '012 PATENT UNDER THE DOCTRINE OF EQUIVALENTS?

A. I THOUGHT THAT WAS WHAT YOU ASKED PREVIOUSLY.

Q. PERFORMED AS TO INLINER 1.

A. INLINER 1 DOES ACCOMPLISH THE — OR IS AN INFRINGEMENT UNDER THE DOCTRINE OF

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EQUIVALENTS. INLINER 2 IS ALSO AN INFRINGEMENT UNDER THE DOCTRINE OF EQUIVALENTS.

Q. BECAUSE OF THE ANALYSIS THAT YOU'VE MADE PREVIOUSLY

A. YES.

Q. — WITH RESPECT TO THE THREE ASPECTS OF THAT DOCUMENT?

A. THAT'S CORRECT.

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